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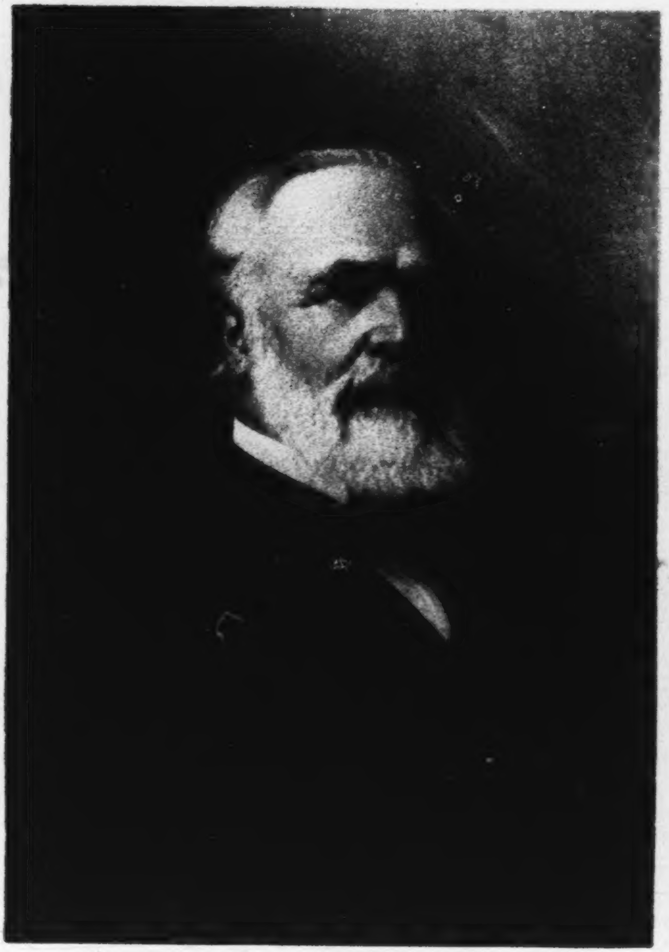

W D Whitney

LIFE AND LETTERS
OF
JOSIAH DWIGHT WHITNEY

BY

EDWIN TENNEY BREWSTER

WITH ILLUSTRATIONS

"WHITNEY'S OWL"

BOSTON AND NEW YORK
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PREFACE

The original idea of this biography is, in part, Professor Whitney's own. Some time before his death, he arranged with Professor William H. Brewer of Yale University, who had been his chief assistant on the California Geological Survey, that Professor Brewer should at some future time write the history of their work on the Pacific coast. Of this task Professor Brewer had made a considerable beginning, and his ample notes are the basis of so much of the present work as deals with the period between 1860 and 1874. On this portion of my work I have, besides, been greatly aided by Mr. Charles F. Hoffmann, Chief Topographer of the California Survey, and by the late Robert E. C. Stearns of Los Angeles. Dr. Stearns had been, since the early days of the state, among the most eminent men of science in California; to him I owe the advantage of a competent opinion of surveyors and survey from the outside.

The book in its present form is the project of Professor Whitney's immediate family, and especially of his only surviving sister. She in particular has collected most of the materials, culled out the significant portions of a voluminous correspondence, and supplied from her own recollection a large part of the personal detail, especially of the earlier chapters. Other members of the family have contributed in various ways; and Mr. James L. Whitney has, in addition, read the entire proof.

My hearty thanks are due also to Professors Davis and Wolff of Harvard University; to Miss Mary H. Rollins, who prepared the accompanying bibliography; and most of all, and for more services than I can well enumerate, to my friend Mr. Lindsay Swift.

Professor Whitney himself merits abundantly this memorial. He served on the first geological survey of New Hampshire, and began his professional work when New York State was geologically an unknown land. He took part in the scientific exploration of the nearer West, and did more than any other man to make known the mineral resources of this portion of North America. In addition, he added to the geological map of the United States the whole of California and much of Washington, Oregon, and Nevada. He helped to advance geology from small beginnings into the modern science, and he was besides one of the small group of German-trained instructors who made the American university. He is, therefore, both in science and in the higher education, a forerunner of the present era and a representative of a great day which is no more.

E. T. B.

ANDOVER, MASSACHUSETTS,
September 1, 1909.

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The dome-shaped boulder marking Professor Whitney's grave is a block of Cambrian quartzite brought by glacial action from its distant bed into the suburbs of Northampton, where it was unearthed in the grading of a road. Here it was discovered by one of the Whitney family in 1875, and moved to the home-lawn. Professor Whitney often spoke admiringly of it. Hence its fitness for its present use.

THE BOOK-PLATE on the inside of the front cover represents Mt. Whitney (14,502 ft.), the highest mountain in the United States outside of Alaska. It was discovered and named for Mr. Whitney during his absence, by his associates, Prof. W. H. Brewer and Clarence King, in 1864. It was not ascended till 1873, when W. A. Goodyear, another of Mr. Whitney's associates, ascended and measured the height. The motto "Altiora Petimus" and the figures of the mining surveyors are taken from the Reports of the California Survey.

4.

LIFE AND LETTERS OF JOSIAH DWIGHT WHITNEY

CHAPTER I

BOYHOOD. 1819–1839

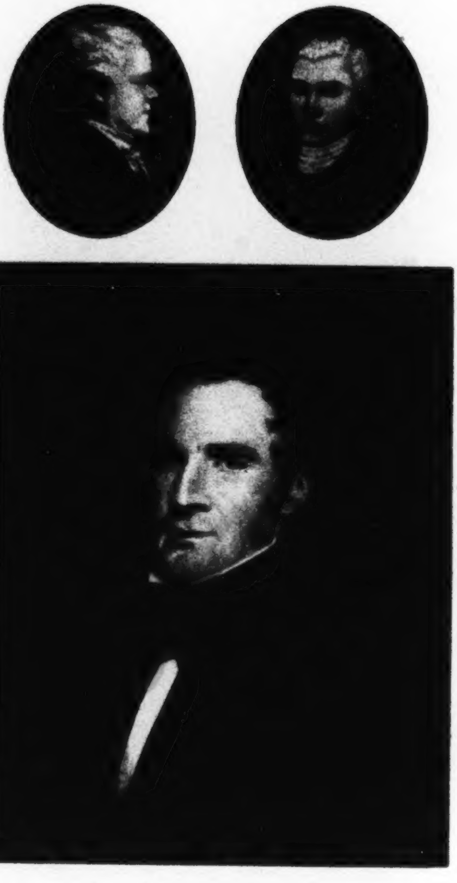
To the Brahmin caste of Dr. Holmes, along with Adamses and Peabodys and Eliots, belong the Dwights. The common ancestor of them all was John Dwight of Dedham, who came over from the English Dedham, in 1634 or 1635, and their habitat was central and western Massachusetts and the lower valley of the Connecticut, together with those parts of New York State that were settled from New England. They took to themselves wives of the Woolseys, Edwardses, Lymans, Hookers, Strongs, Hawleys, Sedgwicks. Their sons graduated at Yale, and became clergymen, merchants, members of Congress, soldiers, missionaries, editors, lawyers, authors, or physicians. In times of peace, they were captains and majors in the state militia; at the taking of Louisburg, in the Revolution, in the War of 1812, and in the Rebellion, a Dwight commanded at the least a regiment. Their type appears in the three presidents whom they gave to Yale College, and in the heads of their great mercantile house — scholars, who were also men of affairs; business men, who served faithfully the state. It is a thoroughly sound and able stock, and although none of its members have been endowed with the highest gifts, few have fallen to mediocrity. Few families have maintained more consistently their level of capacity and achievement.

Clarissa Dwight, daughter of Colonel Josiah Dwight of Springfield, heiress also and belle, married Abel Whitney, whose father, Rev. Aaron Whitney of Petersham, had been a noted Tory in the days before the Revolution. The Whitneys, like the Dwights, were of the migration of 1635, in the person of John Whitney of Watertown. He was from London; but the family is a thirteenth-century stock, of the region about Whitney Town, in Herefordshire, close to the border of Wales. Abel Whitney, graduated from Harvard in 1773, took to the law, helped as major of militia to put down Shays's Rebellion, lost his property in the unsettled times which followed the war, and dying at fifty-one, left to his twenty-year-old son, the first Josiah Dwight Whitney, the care of Clarissa Dwight and her six younger children.

The frugality and the business acumen which Abel Whitney lacked, fell in double measure upon his son. The boy took service with his uncles, the Dwights, and becoming in time their purchasing agent, lived two years in England, whence in 1815 he brought home the first news of Waterloo. After that, he set up for himself in Northampton in partnership with a younger brother, established a private banking-house in 1829, and in 1833 founded the institution which later became the Northampton National Bank, and of which he was for more than thirty years cashier and president. By these various means, he so far retrieved the fortunes of the family, that he became one of the half-dozen most prosperous citizens of Northampton. He built him a house on the main street of the town, on the site of Jonathan Edwards's old dwelling, designing the building himself, and utilizing the old door-step of the great divine. It was this circumstance, probably, together with the fact that one of his uncles married Rhoda Edwards, that got him the name of being himself a descendant of Edwards; though indeed he was both able enough and righteous enough to justify the reputation of Edwards's blood.

Josiah Whitney, senior, had become a confirmed bachelor of thirty-two before, having done his full duty by his father's children, he was free to establish a family of his own. In 1818 he married Sarah Williston, whom he took, a girl of nineteen, from behind the preceptress's desk of Hopkins Academy at Hadley. She was a beautiful and gracious woman, of rare loveliness of character, whom her friends admired and her family adored. She was, however, morbidly conscientious. The daughter of a country clergyman, brought up in a time of theological stress, she lived under the fear of an angry God, and gave to the concerns of her soul efforts which a wholesome-minded woman would have spent more wisely. Eight children she bore in fifteen years, and died when the youngest was a few weeks old.

A year of the confusion of widowers' houses, the elder children sent away to school, the younger given over to the care of relatives whom they did not love, and Josiah Whitney, senior, drove to Goshen and brought home his second wife Clarissa, the daughter of Capt. Malachi James. The new Mrs. Whitney was about the age of the first and cousin to her brother's wife; a farmer's daughter, rich in all kindly virtues, and rich soon in the spontaneous love of her step-children. She too was a religious woman, who undertook solemnly her obligations. "I hope," she writes a few



weeks after her marriage, "that it was not without some feeble desire of doing something for the honor and glory of God that I entered into this responsible place." Responsible indeed it was; and somewhat arduous withal, when, to the eight children of her husband, Clarissa Whitney added five of her own.

The eldest of the thirteen is the subject of this biography, Josiah Dwight Whitney, Jr., who was born in Northampton, November 23, 1819, and was therefore fourteen years old when his mother died. The education of parents usually proceeds at the expense of the first child, and Josiah in his early years underwent a discipline which the younger members of the family were fortunately spared. Under the influence of older and sterner members of her family, his mother often did violence to her gentle heart, and in the effort to break her little son's will, punished him unreasonably. The harsh regimen seems in no wise to have diminished Josiah's love for his parents; it may well, nevertheless, have been the cause of a certain cloudiness of temper which he never completely outgrew.

The younger Josiah Whitney made his first acquaintance with the world beyond Northampton during the summer after he was eight. There were only district schools in his native town, but twenty miles away among the hills at Plainfield, Rev. Moses Hallock took boys into his family to be educated. Visiting has always been a means of culture in New England, and in the old days it was the custom to exchange children among relatives, or to send them away for a winter, that they might attend school and learn something of the ways of other households. "Parson" Hallock had somewhat systematized the general practice. He took four or five little boys into his house, taught them the common branches, trained them to do his chores, and presented each with a lamb to bring up — the animal, however, reverting on the boy's departure. The Hallocks were no ordinary people, and their home school, during the thirty-five years and more of its existence, helped to educate some three hundred pupils, among them the poet Bryant and John Brown of Ossawatomie.

Here went Josiah Whitney, in the summer of 1828, when the parson was nearly seventy and much of the teaching had fallen to his daughter, Miss "Patty" Hallock. With him were three other Northampton lads, one of them a grandson of Caleb Strong, Governor of Massachusetts. The boys reserved their opinion on the quality of their instruction, but were unanimous concerning the plainness of

Plainfield living. One of the four ran away and went home, complaining that, since his education had been in progress, he had had nothing to eat but potatoes and milk. Those, however, were the days when parental authority was wont to assert itself, and the little lad went back to his potatoes in short order; while, by way of making him remember his lesson, he went on foot, twenty-odd miles over New England hills.

Josiah remained with the Hallocks until fall; then returned home, the proud bearer of the following document:—

This certifies that Master Josiah D. Whitney has, while my pupil, conducted with much propriety and beauty.

Three months have passed fleetly and delightfully along, enlivened by his vivacity, and cheered by his intellectual improvement and grateful affection.

Ever attentive to instruction, O! may he listen to the precepts of "Eternal Wisdom," and so bloom above the skies!

His affectionate instructor,
MARTHA HALLOCK.

One incident only has survived from these early days. Josiah was a lad of eight and an aunt was teasing him, saying that when he grew up he would probably have to content himself with being a boot-black. "Well," replies the boy, "if I am nothing but a boot-black, I'll be the best boot-black there is!"

After the summer at Plainfield, private schools and the Southampton Academy took care of Josiah's education until he was twelve; then he entered the Round Hill School at Northampton. This was an unusual institution, a copy of the French and German schools for boys, and "the first in the new continent to connect gymnastics with a purely literary establishment." It had been founded by Joseph Green Cogswell and George Bancroft; the former was still its head. Its students came largely from Massachusetts and New York, but there were many also from the South and West, and a few even from Mexico, the West Indies, Brazil, and Europe; while among the three hundred pupils of its short ten years of existence, a remarkable number afterwards became famous. Amidst these uncommon advantages, Josiah remained two years. Then in the autumn of 1834, Round Hill proving, it would seem, a little too cosmopolitan and worldly, he followed one of the masters, Stiles French, to the school which he established at New Haven.

JOSIAH DWIGHT WHITNEY, SENIOR, TO STILES FRENCH, ESQ.

NORTHAMPTON, *October* 4, 1834.

MY DEAR SIR, — With this I send you my son Josiah, whom I commit to your care, with a full confidence that you will do all that can be done to promote his *education* and prepare him for usefulness in *whatever sphere* Providence may design for him. Such is my general wish, and when I say "education," you will understand me as meaning not merely cultivation of the intellect, but also of the heart and manners — everything, in short, that prepares a man for usefulness here and happiness hereafter.

I am not aware that Josiah is "immoral," or has any *vicious* habits. You may well suppose that he has suffered from the loss of a *devoted* mother — one who was eminently qualified to superintend the education of her children. This loss he has severely felt — nor do I think he has escaped imbibing some, perhaps many, wrong notions and feelings from associating with the boys on Round Hill. I trust they are not so deeply rooted but that you may easily counteract them.

I have not consented to his going to New Haven and incurring such an expense — which I cannot afford for my other children — without a full understanding with him, that he is to make the most of his time, apply himself closely to his studies, and strive to fit himself for business. On his part there seems to be a cordial acceptance of these terms and a determination faithfully to fulfill the conditions. It is of the utmost importance to him—for altho' I shall, if no misfortune befalls me, have something to give my children that will *aid them;* when divided among them it will do but little toward making them independent, and they must depend upon their own exertions. I wish to do all I can to fit them for taking care of themselves and being useful, rather than lay up the money for them.

It was the earnest desire of his mother, and is mine, that Josiah may become a devoted minister of Christ. At present he is inclined to go into mercantile business, and I wish therefore the two objects to be kept in view. From what you have known of his education, and what you will learn from him, you will be better able to judge of the studies he had best pursue than I am. I wish he should retain all he has learned, that would prepare him to enter college (in case he should hereafter alter his mind), and to make such advances in these studies, that he might enter at an advanced standing. You will oblige me by reporting to me his progress and conduct, and your views of the best course for him, as often as convenient. I beg at any rate that he may not suffer for want of *full employment*.

Josiah is very desirous of continuing his attention to drawing. I have not denied him the privilege, but have referred him to you. I have not much money to spare for mere *accomplishments*, but I think it important that every young man should have some occupation for his hours of relaxation, to prevent his falling into bad habits or bad company. He is, I think, naturally *shy*, especially of the best society, and therefore perhaps the more needs such occupation. I would not however think it proper to waste much time or money in that way. If you can draw him to be interested in such society, I think it would be of essential service to him.

Thus the father to the pedagogue; and thus, from time to time, to the boy himself: —

My dearly beloved son, — . . . I cannot express to you how much I was gratified by your visit — and chiefly because I saw an improvement in your character and feelings, which assured me that you were in the way of preparation for happiness and usefulness. . . .

I hope you will write again very soon, and tell me all about yourself and your own feelings and wishes; these are what I am most interested in. During the present term you will have time to think much of the subject of your future course of life. I shall be glad to consult your taste in the matter, but I trust you will see the absolute necessity of having some occupation by which to obtain a living, when you cease to lean upon me — and as that day must surely come before long, it would be the height of folly not to anticipate and prepare for it. . . .

I want you to bear in mind *constantly* that the happiness of your whole life depends very much upon the improvement you make and the habits you form during the time that you are with Mr. French. Habits of self-denial and habits of *application* to whatever you undertake, can alone fit you for usefulness or happiness. . . . I do not wish you to be *mean* in anything, but *careful* and to *waste nothing*. Nor do I wish you to practice so much self-denial as I was obliged to the first 40 years of my life. But *you must avoid contracting wasteful or extravagant habits* of any kind, of which *self-indulgence* is one of the most dangerous. Only look forward to the time not far distant when you must provide for your own wants, and you will see the important bearing of the subject. You cannot then feel an honorable independence, unless you are able to provide for yourself, without asking favors of friends. . . .

Avoid all places of vice or doubtful amusement. Never let me hear of your being once seen in an oyster shop, or eating or drinking house, or even Confectioners' Shops, unless it be for the purpose of getting sugar plums for the children. Such places are in the certain road to ruin. . . .

Within the last week the dead body of your late schoolmate, David Adams, has been brought home from Pittsfield. It is a severe blow to his widowed mother — but she has the consolation of believing that he was prepared to depart to a better world. I hope it will lead his companions, especially my dear Son, to consider the uncertainty of life, and the importance of being prepared for an exchange of worlds. I hope you will not forget the good counsel your own dear mother has so often given you — how painful would be the thought that any one of us should be missing at the great day.

I shall be disappointed if you do not write us this week. . . .

Yours truly and affectionately, J. D. W.

If you have a Virgil that you do not need, either at home or with you, it may save me the expense of a new one — if at home, tell us where it is; if at New Haven send it by the first opportunity. . . .

Don't let your next letter stop till you get to the bottom of the third page.

Meanwhile, in the household at Northampton, there had been much anxious thought and much anxious prayer over Josiah's future. The immediate call of the Dwight blood was toward a business career; Whitneys, Willistons, and Birdseyes had followed the professions. Both parents would have rejoiced had their eldest-born felt called to the ministry.

Either choice would have satisfied the father, whose own health threatened to break down under his unremitting toil, so that he was impatient to see a son on the way toward filling his place. As for the boy, he showed no special talent for business; and on the other hand, here he was, fifteen, and not even converted. He had a decided gift for music, like most of his family; he sang well, and played several musical instruments, self-taught. He drew not unskillfully, and he loved pictures and all beautiful things. At New Haven, moreover, he had come under the influence of the elder Silliman, whose popular lectures on chemistry had founded in him an interest in natural science. The trouble was that the world called him with too many voices; and no one of them sounding louder than the rest, he put off the decision and headed for college.

With Harvard in the hands of the Unitarians, Yale was somewhat inevitable for either a Dwight or a Whitney. Josiah, however, went first to Phillips Academy at Andover, a school even then famous and sixty years old. There, in a year, he completed his preparation for college, anticipated the studies of the freshman class, and was ready to enter as a sophomore in the fall of 1836. It was, nevertheless, doubtful how far Josiah would be able to carry out his project. His father's health still continued to be uncertain; and Josiah, the idea all his own, offered, if that did not mend, to give up all plan of a college education, return home, and enter his father's bank.

One letter only survives from the Andover days; to his sister Elizabeth, who, two years younger than himself, was of all his brothers and sisters his special friend and confidant.

ANDOVER, *February* 22, 1836.

MY DEAR SISTER, — . . . Upon rummaging my trunks to find the last letter, I have found that the date of my last letter from home is

Jan^y 1, and here it is 22, Feb^y. I have received two bundles from home, one containing Chessmen, etc., and the other a pair of pantaloons and Todd's "Student's Manual." I felt in all the pockets, shook the book, turned the papers over and over again, and knocked over the table hoping to find a letter, but no, not so much as one word. Those new pens will be rusty for want of use. A fortnight ago last Thursday afternoon, not having felt well for the last week and our class being engaged in reviewing what was familiar to me, I walked down to Boston [20 miles] with one of our boarders. . . . I engaged to meet my companion in Boston at 10½ Saturday, but although I waited until 12 he did not make his appearance. So I started alone at 12½ and reached Andover at six o'clock. . . . How does the Northampton Female Seminary flourish? I should like to hear all about it, how far you have got in your Greek, and how far in your Hebrew. There is a female school here, where several of our boarders and two of Capt. West's daughters attend. Broad hints are thrown out that young ladies come to Andover to school for the sake of finding a help-mate. I should like to hear about the boys' school, which I suppose William attends. The present term of our school is out in about 6 weeks. We have some good scholars and some blockheads. All the boys in my class are fine fellows. . . . Please to tell Father that I should like to have him send me some money. . . .

Your aff. brother, JOSIAH.

The letters which young Whitney wrote home during his three years at Yale, and the replies which the entire family, as fast as they learned to write, joined in sending him, would alone fill this volume. I select, therefore, a small portion of those which he addressed to the same charming correspondent whose acquaintance the reader has already made. She on her side, during her brother's course at New Haven, graduated at the female seminary in Northampton, went as pupil-teacher to the Abbot female seminary at Andover, graduated at the head of her class, and by the time Josiah was through college, was settled at Ipswich, teaching in still another female seminary there. The two, therefore, though they wrote at length and intimately, saw little of each other. Postage in those days was high, twenty-five cents for the customary single large sheet, folded to be its own envelope and sealed with wax. Such a missive, well crossed or written upside down between the lines, would contain a third of one of the chapters of this book. One such letter a month from each absent member was the rule in the Whitney family. Those which follow, written during Josiah's college days and up to the reform of the postal laws in 1845, should be understood to give, in general, less than half the actual text.

TO HIS SISTER ELIZABETH

YALE COLLEGE, NEW HAVEN, *March*, 1837.

. . . Well, I suppose that you will like to hear how matters and things go on in College. Just imagine me with my feet on the top of an Olmsted stove, my room-mate on one side of me and a table between us covered with books and papers to the height of 3 or 4 feet, engaged in writing a composition which has got to be read before the division the next day. No enviable task! Or imagine that I have just completed the formidable array of sums for the next recitation, and am ready to sit down and write you as long a letter as I can. Everything goes on in College in the same regular routine; recitation succeeds recitation. We go to breakfast, dinner, and supper just like so many automatons. We now rise at 5½ o'clock, and have evening prayers at the same hour in the afternoon. Perhaps you would like to know how we spend our time that we have which we do not devote to study. In the first place, almost every student belongs to two or three literary societies, for which he has to furnish essays, debates, orations, etc. If a person attends to these as he ought to, they require a great deal of time. It is considered an honor to be elected into the societies in the two upper classes. This is one way in which time is consumed. There is another thing which is a sad enemy to time, namely "loafering," i. e. visiting one another's rooms without any ostensible purpose, to pass away time. Every one who rooms in College is liable to this, and this is the greatest objection to rooming in College.

Another thing which requires time and which every one must attend to if he hopes to have any sort of health, is exercise. For that purpose we walk about the streets and alleys of New Haven, play in the Gymnasium, etc. One of the great *bores* in college is declamation in the chapel, which we are obliged to perform twice a term before the faculty and all the students. I have made a good many pleasant acquaintances this term, not only in our class but in other classes. College is a world in miniature; there are a great many fine fellows who would appear to advantage anywhere, and a great many who are more fit for the stable or the grog-shop than for the literary pursuits of a college. . . . But although engrossed with the busy cares and pleasures attendant on my residence here, do not think, my dear sister, that my feelings seldom revert to the scenes in which you are a partaker. Far from it,—"Home, sweet home" is ever present to my mind, to comfort and to cheer. . . . I should suppose that all Northampton had been converted to Abolitionism as they have had so many lectures there. We don't hear so much about the subject lately, as we used to. Mr. Webster is expected to deliver an address here to-morrow, as he passes through on his way home. . . . It is about the time now for playing ball, and the whole green is covered with students engaged in that fine game: for my part, I could never make a ball player. I can't see where the ball is coming soon enough to put the ball-club in its way.

TO HIS SISTER ELIZABETH

New Haven, *January 29, 1838.*

Praps you will ax what I have been doing this term. Well, 1st, I have not injured my health by hard study — this will no doubt be a comfort to you to hear. 2nd, I have not injured the system by an overabundance of rich food, and while boarding in Commons, have carefully refrained from all the rich and tempting variety of pies, cakes, roast turkeys, oyster pies, etc., daily spread before me. 3d, I have not blown myself away by playing the flute, nor got into a scrape playing the fiddle. On the contrary, I have been a good boy, or as Horace says "a good shoemaker." Our venerable Professor of Unnatural Philosophy and Stoves [evidently the physicist, Olmsted], being confined to bed with the lockjaw caused by uttering some of his own vile English, has given us more to do this term than usual. Juniors are lazy animals to make the best of them, but compared with Seniors they are locomotives flying at the rate of 50 miles an hour,—the personification of industry, the acme of diligence. . . . How comes on Abolition? I want you to send me on the first copy of the Northampton Abolition paper (if it is ever started), as soon as possible. I received a very ancient copy of the "Emancipator" the other day. I could hardly decipher the date, but should suppose from various circumstances that it might have been issued about the time of the Universal Deluge, and that Noah had used it to teach his oldest child his A, B, C's out of.

TO HIS SISTER ELIZABETH

NEW HAVEN, *June* 26, 1838.

. . . It was so dull here when I got back—that on Friday I went down to N. York to visit the exhibition of the National Academy of Design, *et cetera.* We went down in the "New York," the fastest steamer in the world, performing the distance of 86 miles in 4 hours, forty minutes! . . . I spent about four hours in the Ex. and then went all about the city to purchase materials for Painting in Oil, and some Music. . . . The next day we returned and once more took up our stations in the cider-mill track of College Life. You cannot imagine a pleasanter room than that which, as No. 1, fell to my share; a corner room with two bedrooms, each in itself a pleasant room, delightfully shaded and looking out upon the Green, and comfortably furnished and ornamented with paintings by a "*distinguished master.*" Here I, solus, lounge or paint or fiddle or *study*,—the latter not very often however. We have enough to do; Optics, Astronomy, History, German, with lectures on clams and squids and lobsters and *shell*ology and also on Botany pretty well occupy our time. I have also commenced Painting in Oil, for my own amusement. . . .

If the day is pleasant, I very often go out of the city 3 or 4 miles, after breakfast, and spend the forenoon rambling about for flowers and sketches. Besides painting, which I devote as much time to as I can possibly spare, I am very enthusiastic in learning German. I and a classmate, who is from Pennsylvania, where they talk German a good deal, hardly speak to each other in English. I am reading Goethe's Autobiography. . . . I have the honor to be elected member of the Φ B K and X Δ Φ Societies.

TO HIS SISTER ELIZABETH

New Haven, *February* 3, 1839.

Since I wrote last I have been home and enjoyed a delightful vacation of a couple of weeks. I reached home New Year's morning just in time to enjoy the sight of an innumerable number of stockings stretched along from one side of the fireplace to the other, all filled, — nay *stuffed* with good things, among others one inscribed with my name, in which there was a beautiful *bible* from Mother. . . .

Here I am, the same as ever, studying Philosophy and Political Economy a little, painting a little, reading a little, fencing a little, doing nothing a good deal. I am dipping a little into the well of English literature of olden time together with my friend of the musical name. We are reading together Ben Jonson's plays occasionally, or Shakespeare, Jeremy Taylor, Chaucer, Spenser, or perhaps Dryden. Thus we spend many an evening quite comfortably, leaving Mathematics and all the ologies to be scattered to the winds. I think it a great privilege to have good libraries to resort to.

TO HIS SISTER ELIZABETH

NORTHAMPTON, *September* 4, 1839.

. . . .

Commencement, *the* era in a man's life, went off well, better than anybody expected: in fact it was hinted in some of the papers that a better commencement had not been attended in New Haven, and that a finer class never left the walls of Old Yale. However, you know that we never praise ourselves, so that you need not believe any more than you please. As I had to appear twice, once in a Colloquy besides my oration, and as I had to superintend the whole concern as chairman of the Committee, and to play the fiddle into the bargain, you may imagine that I was somewhat busy, and that no one was more rejoiced to feel that it was all over and successfully over, than myself, as we assembled together for the last time, as a class, to partake of a generous supper, at which were not wanting any of the requisites for enjoyment, and when the feeling of sadness that we were to sever those ties that had held us together for four years, was forced to yield to the general joy. . . .

Well, Father was not at New Haven, nor a soul of any of my relations or friends, much to my disappointment. I assure you I thought of you often on that same day, and while the rest of my classmates were flourishing about with their sisters and *other female friends*, I was completely solus. . . . The crowd in the city was enormous and the heat astonishing, so that many there were who did sweat much on that eventful day. Our Commencement dinner, for which we were charged $2.00, was composed principally of roast pig and succotash; and them is all the particulars about Commencement I am going to inflict upon you. . . . I start day after to-morrow for Niagara — Montreal — Quebec — Lake Champlain.

Good-bye.

J. D. W., Jr., A. B.

Three years at Yale had done for Josiah Whitney very much what a college course in his day was intended to do. So much of classics and mathematics as the curriculum prescribed he had dutifully absorbed. In addition, he had learned to ride, to dance, to fence, to enjoy long walks in the country. He sang in the college choir, and played the fiddle, flute, and guitar. He drew accurately, and painted in water colors and in oils. Of modern languages, he read somewhat freely French, German, Italian, and Spanish. Of sciences, though his real training came later, he knew the little that the colleges of his day taught of physics, chemistry, astronomy, geology, paleontology, anatomy, mineralogy, botany. More important than the knowledge of any special science, he had been the pupil of Olmsted and Silliman. He had, besides, become so omnivorous a reader of English literature, that as an incident to a vacation at home during the winter of his senior year, he devoured in two weeks, Wordsworth's poems, "Sir Charles Grandison," "The Faerie Queen," Robertson's "Charles V.," Cowper's Letters, Johnson's lives of a half-dozen poets, a book of travels in China, and a controversial work on slavery. In addition, he had already begun to collect a library, chiefly of English classics, modern literature, and science. He aspired to know eight languages and all the natural sciences; but he despised philosophy, cared little for mathematics and hardly more for physics. Chemistry was his chief interest, and geology his avocation. His suggestions of laziness in his letters are merely the undergraduate pose. In reality he was a diligent student, with a tenacious memory and an insatiable interest in the things of the mind. His membership in the Φ B K society is witness to his high academic standing; his chairmanship of his class committee, to his executive ability.

One failing, nevertheless, neither college life nor his father's reiterated admonitions had been able to cure — his native unsociability. Like many another shy man, he could be brilliant and fascinating in the company of those whom he found congenial,—his friends and his family loved and admired him; but he would not put himself out to please people whom he did not like. He had unusual independence of mind; and he paid the price in a corresponding deficiency of the gregarious instincts. His father thought him extravagant, not because he was wasteful, but because he was fastidious and loved good and costly things. He could do without, but his clothes and his book-bindings and his concerts, if he had them at all, must be of the best. Of these two characteristics, the one gave him, throughout his life, a cultivated appreciation of all forms of excellence; but the other limited his efficiency till the end.

CHAPTER II

DR. JACKSON AND THE NEW HAMPSHIRE SURVEY. 1839–1842

THE community to which Josiah Whitney returned, when after his course at Yale he came back to his father's family to work in his father's bank, and to which he returned many times in the years which followed, was one in which he might easily be happy. The village of Northampton is a charming one, beautiful for situation, wide and shady of streets, with the great elms and the stately Georgian houses which are the special charm of the older New England towns. The people were all of New England stock, neither poor nor rich, simple, dignified, earnest. If life in such a community appears somewhat straight-laced, let us not forget that the Puritan tradition carried also a familiar acquaintance with two or three of the world's great books, and with some of the best household furniture that human taste has designed.

In such a society the Whitneys were natural leaders. They kept open house for relatives and friends, and the children made long visits back and forth with their cousins. The two elder daughters, Elizabeth and Sarah, largely for the adventure, went south to teach in a private school in Georgia; and their southern acquaintances, in return, visited them at Northampton during several summers. It was a household in which a Virgil or a Classical Dictionary ran through the family; where the purchase of a stove for the kitchen, a carpet for the parlor, or a lamp for the front hall, were matters to be communicated to absent members; but where money was always forthcoming for books, for travel, for lectures and concerts, or for expensive schools. It was a family, moreover, that could rejoice to sit down at dinner at "a good long table full of Abolitionists," and advise the rejection of a suitor, otherwise eligible, who was an Episcopalian and thought it not wicked to attend the theatre.

The entire family was musical, so that when Josiah, always the devoted slave of his sisters, was not taking them on picnics and horseback rides, doing escort duty of an evening, or dancing with them in the parlor after supper, he was pretty likely to be singing in the family quartette, or playing duets on flute or violin. Those were leisurely days, and often, as the young women sewed, Josiah read aloud — Jane Austen, Carlyle, Dickens, and Elizabeth's special discovery, "an English writer of the present day," a comparatively unknown person called Tennyson. Josiah was, too, the special favorite and playfellow of the younger children. He welcomed each new addition to the steadily increasing troop, watched with manifest pride the unfolding of their varied gifts and graces, and made himself in amusements as well as in studies their sympathizing friend and adviser; while under his initiative, each child was encouraged to cultivate whatever musical talent it had, that it might contribute its share to the family enjoyment.

When, however, it came to settling down to a vocation, Josiah Whitney was in the situation of a squire of dames, who, admiring many ladies, cannot settle his affections upon any one. Art, music, science, business, even the law, attracted him by turns. He even considered buying the farm of an uncle at Portage, New York, who was tired of the wild west, and wanted, as he said, to move back east nearer to his friends, where he could find out oftener than once a week what was going on. Josiah did not like banking, and he did like chemistry. So for want of any better plan, he went to Philadelphia for the winter of 1839, to study chemistry with Dr. Robert Hare, professor in the University of Pennsylvania, inventor of the oxy-hydrogen blowpipe, and one of the foremost American chemists of his day. Fortunately, the pastor of the family church in Northampton had shortly before changed to a Philadelphia pulpit, and Josiah had other friends in the city, besides.

TO HIS SISTER ELIZABETH, TEACHING AT ABBOT ACADEMY, ANDOVER

November 2, 1839.

MY DEAR ELIZABETH, — How do you affect the hill of Science and East winds? My teeth chatter at the very idea of the liberties which Jack Frost was and is wont to take with nose and toes in your inhospitable regions. How have you been piling on the hickory logs, while I have been luxuriating in the glories of the Indian Summer, roving on the banks of the Schuylkill during the balmiest days of the finest season of the year! . . . Hitherto I have had nothing to do but to kill the Lions of Philadelphia, as Dr. Hare does not begin his lectures till next Monday, when I expect to become more of a working man, head over ears in pots and kettles, retorts and alembics, and all the paraphernalia of a well-stocked Laboratory. . . . [Here follows a long account of the lions of Philadelphia, and of the ways of Philadelphians, strange to New England eyes.]

. . . The Academy of Fine Arts, which is constantly open, contains together with West's sublime painting of "Death on the pale Horse," a number of beautiful originals, particularly a St. Cecilia by Guido, and a gem of a painting by the same, a Ganymede. Then there is Sully's Gallery, which contains, among his other works, his painting of the Queen, Miss Victoria. The churches here — or those which I have been into — are not very remarkable specimens of taste. St. Stephen's contains a gorgeous painting on glass of King John signing the Magna Charta. Mr. Todd's church, where I went half of last Sunday, is very elegant inside. The music was very good, especially Mr. Kingsley's performance on the organ, which was very fine indeed. But "jam satis," I presume you are ready to cry out, and I verily promise that I never will inflict such another catalogue upon you. . . .

I have called at Mr. Todd's once since I came here, and intend to call on Miss Gould. I saw her at church last Sunday. I also dined at Mr. Wharton's. He has two daughters about your and Sarah's ages, who talk German like a book and play divinely. This is decidedly a musical city, fine concerts here very often. I find that I am almost in the midst of as musical a set as Hogarth's enraged musician ever was. I have two flutes on one side, which murder most villainous duets, one ditto 'so-low' up stairs, one piano on the other side, thumped with more zeal than science, and to crown all, about a wagon-load of babies down stairs, not to mention that every sweep and coal-seller and newsboy in the city seems to redouble his exertions as he comes under my window. But still I consider myself very comfortably "located," — good rooms and near to the few acquaintances I have in the city.

Now as you owed me a letter before, I send you this as fair warning that if you do not answer me immediately, I shall scratch your name out of my books and close my account with you — besides cutting you off with a shilling in my will. Direct to 74, 4th Street to

Yours truly and affectionately,

J. D. WHITNEY.

FROM HIS SISTER ELIZABETH

ANDOVER, *January* 8, 1840.

MY DEAR, DEAR BROTHER,— . . . Perhaps you will wonder that I am passing my vacation in *Andover*. I am remaining here to *study* some and read, etc., *instead* of passing the time in Boston, as I had a very urgent invitation to do. I am reading *Tasso* — not in the *original*, but I wish I knew Italian so that I could — but Hoole's translation of it. One other young lady and myself are looking over the different poets, studying *prosody*, etc., and reciting to Mr. Stone. It is a very pleasant way of passing the vacation in my opinion. What think you of it? I have been dipping into metaphysics, the last term, have taken up the *Will*, and have studied *Edwards's* and Pres' Day's books. Next term we study *Upham* on the subject. I am very much interested in it, but have not decided as yet which side I shall take in the great controversy on the subject. I do not mean to make up my mind until I have studied thoroughly. . . .

Don't think you weary me with your catalogues of *sights*, for I admire to hear about anything you see. All those that you wrote me of, interested me much. I pray you, don't fear to tire me with such things, you never do, or can. . . . Dear, dear Josiah, you know, you *must know*, that I long to write you on the most important of all subjects. I cannot bear to send this letter away without saying at least a *few* words to beg you to think. Why won't you tell me how you feel, if you have any feeling at all on the subject, and tell me if you dislike very much to have me write you anything on the subject, and if it does you more harm than good? I know you are older and know so much more than I do, that I cannot bear to speak of what I know you must know as well as I do — no, not *as* well, for if you could *feel* as I do, you would think that you can be happy in no other way than by devoting all your talents to the Author of your being — to Him who gave you all, and who will, one day, require of you all you have received. Now forgive me for writing thus. I cannot help it. Do I pray you, my own dearest brother, think of these things, and intrust me with your thoughts. Will you not?

TO HIS SISTER ELIZABETH

PHILADELPHIA, *January* 23, 1840.

A severe attack of inflammatory rheumatism, which has confined me to my room for a fortnight, must, my dear sis., be my excuse for not immediately answering your long letter. I could almost pardon your long silence, in consideration of the peculiar gratification I felt in hearing from one whom I had almost given up in despair as a correspondent, although I did not really believe but that you still in some measure recollected me, your elder brother. But really you treated me shockingly, *n'est-ce-pas?* I had made half a dozen resolutions to give you up as a gone case, but they were all scattered to the four winds on seeing your well-known superscription.

They have not treated me very well at home.

I have not heard a word from Sarah: for aught I know she may be friz in a snow bank fifty feet deep. But I have forgotten what I had to tell you in my last letter, it is so long since I wrote it. Let me see. I must have talked a great deal about *I*. How *I* was a chemist and smelt of bottles; how *I* burnt his fingers and nose with acids innumerable; how *I* blew up occasionally, and the other interesting varieties of Laboratory life. Now, pretty much all I have to say is that I have been quite sick, am getting better, and hope in two or three days to breathe the fresh air of heaven, instead of the confined atmosphere of a sick chamber. My friends have all treated me with a great deal of kindness and attention, alleviating as much as possible the misery of being sick anywhere, and especially away from home. . . .

You almost petrify me with horror at the bare mention of the books you are studying. I *do* hope you won't take to writing on Metaphysics, for of all the branches of human Science for a young lady to dip into, that seems to me the last.

I wish you would direct the current of your mind toward some of the modern languages, and penetrate the stores of knowledge which lie hidden under the veil of the German language. I shall never give up until I persuade you to learn that wonderfully rich and copious language. I have just been reading Mrs. Hemans's life and was surprised to see how much she owed to that language and her unbounded love for its literature. It is all the fashion at present among the Philadelphia ladies to talk German. I know several who speak it like a book. This is a very musical city, and of course there are all sorts of musical parties going on, as well as concerts and soirées, etc. I went to a few to see how they carried on such things here, but as I found that invitations increased geometrically, while my time was decreasing in a like ratio, I was obliged to give them up almost entirely. You recollect Mrs. Kingsley. I have called there several times; she spoke of you as an old acquaintance. They are delightful musicians and it is quite a treat to hear Mr. K. play at Mr. Todd's church, where I generally go.

You must excuse the brevity of this letter, as I am still as weak as water from the effects of leeching and starvation. I hope that you will answer this immediately and then I shall be well enough to write you a *long letter.*

Your affectionate brother,
J. D. W. Jr.

To that part of his sister's letter which was most important of all to her, Josiah makes no reply. Nor does it appear that the condition of his soul ever gave him any special concern. True, he had lived all his life among religious people, and he was at this period a pretty regular churchgoer. But he was also a geologist; and those were the days when a thousand pulpits were shouting denunciation of Lyell, and the test of orthodoxy was a belief in six days of creation and a universal flood. To this bitter controversy over the age of the earth, there succeeded, after 1859, a struggle no less bitter over the theory of evolution. Between the two, for the young man of science, the way into the kingdom of heaven was indeed strait.

For Whitney, however, there was in all this no such soul's tragedy as, let us say, overshadowed the life of Romanes. He was essentially a "tough-minded" person. His family affections and the two arts which he cultivated satisfied his emotional needs; he was too thoroughly pragmatical to trouble himself over predestination and free will. In short, he was an unimaginative young man, contented to do his day's work, and to let the universe go on in its own way.

This attitude he retained throughout life. He was never a scoffer at religion; he even went to church when it suited his convenience, and in a loose way counted as a Unitarian.

But he had too much steady-going morality to experience any conviction of sin; and thus he adopted, in the forties, the attitude toward religion which, nearly two generations later, has become well-nigh universal among scientific men.

Such an attitude, naturally, was altogether incomprehensible to his mother's daughter; and the troubled girl, her brother's illness still on her mind, added at the end of a long and affectionate letter, "could we ever have been happy again, knowing that one we so dearly, dearly love had gone, and we should never, never see him again — never even in eternity."

As for the concerns of this world, with March of 1840 young Whitney was back again at Northampton, uncertain as ever about his future career. It happened that the elder Whitney numbered among his acquaintances no less a man than Charles T. Jackson, chemist and mineralogist, and world-famous a few years later, as a discoverer of anesthesia. Jackson, trained abroad and a pupil of Élie de Beaumont, had already made the first official geological surveys of Nova Scotia and Rhode Island, and was then State Geologist of New Hampshire. He had, besides, a private laboratory in Boston, where he had some half-dozen pupils and assistants: in fact, he seems to have been the first person outside of Germany to teach chemistry systematically by laboratory methods. To him, early in April, went Josiah Whitney with his father's note of introduction, and letters from Silliman and Hare.

Dr. Jackson was most kind. He made Whitney his companion at a meeting of geologists in Philadelphia, tried to find him scientific work, and failing in that, took him into his laboratory. Jackson himself was having trouble with his legislature, an experience by no means uncommon with the heads of geological surveys; and by way of circumventing the politicians, who demanded that all salaried positions on the survey should be filled by "citizens of New Hampshire," he arranged with the governor, John Page, to have no paid assistants at all. Instead, he took the men from his laboratory, several of whom already knew something either of geology or of engineering, and all of whom volunteered to serve without pay, with the chance that the legislature might, in the end, refund their expenses. Whitney, in default of anything more remunerative, joined the party; and proving to be the most capable of the young men, was set to work somewhat independently with one associate.

Dr. Jackson's official instructions for Whitney's first geological work were as follows: —

"Messrs. J. D. Whitney, and M. B. Williams are authorized by me to act as assistants on the Geological Survey of the State of New Hampshire. They will proceed to make a series of sections across the rock formations of the state, for the purpose of delineating the extent and limits of the different rocks. They will represent the same, upon the map of the state, in colors, and also in profile. They will measure the heights of mountains, from their bases, and from the sea-level, and will note the latitudes and longitudes of the different places which are of sufficient importance. They will examine the dip and direction of strata, and note their contents; the direction and the dimensions of the beds or veins of useful minerals, collecting specimens for the state cabinet and for chemical analysis. They will also collect specimens of all remarkable soils, for the same purposes, noting the crops raised thereon, with such other statistical information, as can be obtained.

"They will note the direction of mountain ranges, in relation to the theory of Élie de Beaumont.

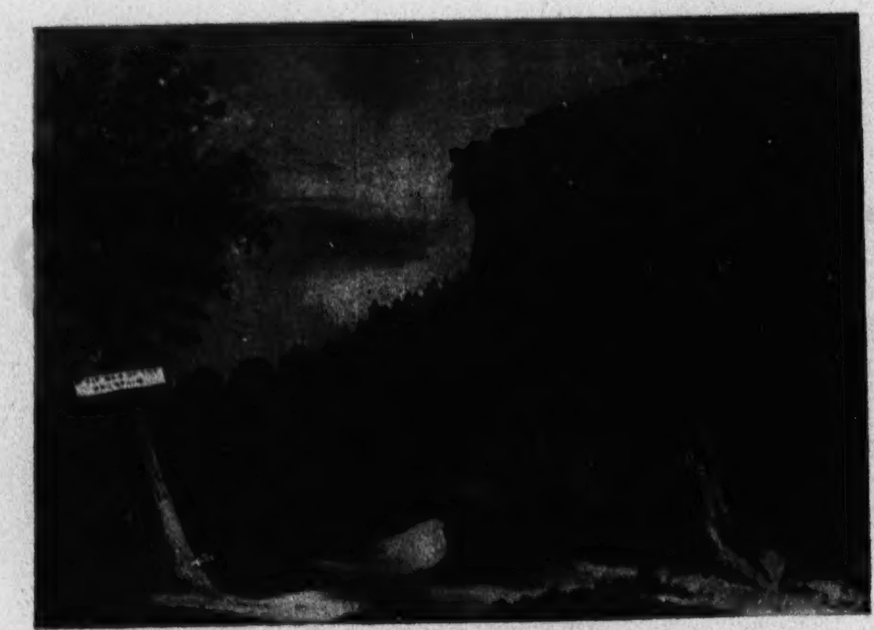
"They will correct the Topography of the map so far as practicable, and will collect such statistical information, as may subserve the publick interest."

Messrs. Whitney and Williams thereupon equipped themselves with a large covered wagon and an ancient horse, with tents, blankets, cooking utensils, compasses, clinometers, barometers, theodolite, blowpipes, reagents, drawing-tools, maps; and began that inventory of the natural resources of the state which in the thirties and forties passed for a geological survey. Jackson himself was of all state surveyors one of the most primitive in his methods, while the State of New Hampshire is peculiarly unsuited to be the training ground of a beginner, especially if that beginner is to struggle with Élie de Beaumont's quite erroneous theories of mountain building. It is probable, therefore, that the summer of 1840 brought the two boys little beyond the experience of which one has a glimpse in Whitney's letters to his sister.

TO HIS SISTER ELIZABETH

CLAREMONT, *June* 21, 1840.

MA CHÈRE, — . . . Dr. J. joined us here on Tuesday night, just as we returned from the ascent of Ascutney Mt. and we went on the next day to Proctorsville and Plymouth, Vt., where we spent two days in examining the marble and serpentine quarries, which furnish the finest material in the world for tables and



J. D. Whitney, del.

THE OLD MAN OF THE MOUNTAIN

such like, and when you are married I shall take great pleasure in presenting you with a specimen. We have also visited Acworth and overhauled and explored everything in this region. To-morrow we start for Haverhill, principally to be introduced to the Governor, who originated the Survey and takes great interest in it. . . . I have joined company with Mr. Williams in doing the sections on which *we* are to report in our own name, . . . and we are to work . . . together from the southwest corner of the state, diagonally across to the sources of the Macgalloway river which forms the northern line of the state. . . .

. . . The quantity of our baggage is enormous. Yet *I* find that I have omitted at least half the articles I want, and brought as many that I do not want at all. I will lay any wager that you never would have thought a tin whistle or a gimlet very necessary things, yet there are no two things that we use more. . . . As soon as we begin to camp, I shall begin to talk about those partridges and shall send you a sketch in our first picturesque encampment. There is nothing so amusing and yet so provoking sometimes, as the curiosity with which everybody watches us and our instruments. How often I have laughed at the question whether my Barometer was a gun or a spyglass or a trumpet. We are everywhere treated with attention and politeness, though there is no business which more requires tact and care in addressing the people with whom we are constantly obliged to associate, and who are to give us much information which we need. . . .

TO HIS SISTER ELIZABETH

June 28, 1840.

I took tea at the Governor's house last night. He is a plain farmer, intelligent and unpretending. When we called first, he had just been creeping under the barn for hens' nests—and, of course, presented quite an ungovernorlike air. . . .

The difference between that part of the state which lies on the river and the interior is astonishing. Go ten miles back into the country, and you meet a different order of things entirely, slovenly, disgusting houses, and people neither remarkable for intelligence nor politeness. . . .

One thing goes hard: that is, the eternal repetition of ham and eggs, the one article of food to be found in the state, breakfast, dinner, and supper. Salt pork would be a comfort.

New Hampshire is certainly the most musical state in the Union. Everybody scrapes the fiddle or bass viol, and we are entertained by all sorts of music by night and by day. Those who have no other instrument, whistle most vehemently. We went all over Dartmouth College and every student seemed to be possessed with a musical devil; such an intolerable din of trumpets, drums and human or inhuman voices I never heard before; verily the cast-iron band at New Haven was not to be mentioned the same day. The students there are in open rebellion, and the Faculty do not seem (judging from what specimens we saw) capable of managing them at all.

TO HIS SISTER ELIZABETH

Lower Gilmanton, N. H., *July 26, 1840.*

. . . Unless our plans are altered, a thing very likely to happen, I shall be among the White Hills on the 14th of next month. For the last fortnight Mr. Williams and myself have been engaged in investigating the shores and numerous islands which "*gem the bosom*" of Lake Winnipisiogee. We made Centre Harbor our headquarters, and thence took a boat and boatmen and spent several days in cruising among the islands, camping at night, and finding our food from the abundance of game and fish on the Lake. We live as comfortably and much more pleasantly in camp than in a house, and though one night when we were out it rained violently, it never disturbed our slumbers. The scenery of the Lake is beyond comparison beautiful, especially if it is seen as we saw it. The first night we pitched our tent on the islands, I shall never forget. We had selected a bold shore overlooking the Lake, just on the edge of a dark wood. Here in the strong light of our camp-fire glistened our snow-white tent while around it were gathered our men, whose scarlet and green blankets, as they stood in various attitudes, formed a picturesque group. Before us was the Lake, stretching miles around, with island on island vanishing in the distance, while over all, the full moon, just rising from the water, with a cloudless sky, threw a *pillar* of light over the surface of the water. Never in my life have I beheld a scene which could compare with this in romantic beauty. From one of the islands which rises high and abruptly from the Lake, you have an enchanting view of the Lake and its islands, enclosed in an amphitheatre of mountains. One of these islands, whose fanciful appearance struck me, I proposed to name; and boatmen and neighbors seeming pleased with the idea, and promising to spread abroad the fame thereof, I duly named it on the spot as Elizabeth Island. I will send you a sketch of it when I write on paper which is not ruled. . . .

. . . Father has not written me for a long time, but I intend to write him to-day a letter which will draw tears from eyes, I expect, or in other words, a real dunning letter. Oh! it's bad business, this working for nothing and finding one's self. Good-bye, you and Sarah must both write immediately—now won't you? —or I shan't hear from you for more than a month.

The field work of a geological survey can go on only during the warmer part of the year; the approach of winter, therefore, drove Whitney back to the laboratory of Dr. Jackson.

TO HIS FATHER

Boston, November 7, 1840.

My dear Father,—I ordered while at Philadelphia the works of Berzelius and Rose, the two most important standard works in Chemistry, which it is necessary for every chemist to have by him constantly for reference. I suppose they have arrived by this time at Philadelphia and I should like to send for them as soon as possible. They will cost about $37. I wish also to have an overcoat . . . to keep out the rheumatism and to conceal a dirty coat in my walks to and fro for exercise, my cloak not being thick enough for Boston winter weather. Cost thereof about $30. These are all the wants, except necessary expenses, which I shall have for some time. If you can spare the money I shall be glad to have it as soon as possible.

Your affectionate son,
J. D. W. Jr.

I am at work as though every day might be the last I shall have to acquire a knowledge of Analytical Chemistry.

TO HIS SISTER ELIZABETH, TEACHING IN GEORGIA

BOSTON, *February* 25, 1841.

MY DEAR SISTER, — There is nothing like *distance* to lend enchantment to the view, it seems with you, for you actually condescend to hold correspondence with that naughty brother on whom you would scarcely deign to bestow a condescending look when in your most honorable presence; but as you have begun such a brisk fire, I am sure I shall be happy to do my part to keep it up, and shall in return for this epistle, expect from you an account categorical and dogmatical of all your adventures, accidents, circumvolutions and perambulations, both on foot and on horseback, at home and abroad. . . .

. . . As for me myself — I would not have you for a moment indulge the idea that I am shrinking away to a starved "menotony" (i. e. anatomy), or that my bodily comfort is any way broken in upon. No — by no means. So long as the world turns on its axis without upsetting any of my half-finished analyses, so long as I can enjoy the fragrance of my meerschaum after dinner, and an occasional twang of the guitar, without molestation, so long shall I remain the same comfortable, careless, anything but half-starved alchemistical looking chap. But though the winter's work takes off a little of the edge of health and gives one a little too much of the blues, when gay summer comes with its mountain rambles and wild chase over the country, I grow young and gay, for "a life in the woods" is my motto. My favorite plan now is to go to the Rocky Mountains, as soon as I can find any method of getting there. Then you may expect to hear that "the distinguished traveler, Mr. Whitney, was captured by the Blackfoot Indians and being very fat was supposed to have made them a number of excellent meals"! [Here follow divers travelers' tales.]

. . . But of all the people for that sort of thing, commend me to the Bostonians. A lecturer gets up and tells them that the timbers of the Ark may be still seen projecting from Mt. Ararat! and he is loudly applauded; another shows the gate of Heaven as seen through the biggest kind of a telescope, and they say how wonderful! As a proof of the present rage for lectures and all that sort of thing, 25,000 tickets were subscribed for to Prof. Silliman's lectures on Chemistry, to be delivered at the Lowell Institute. The number of concerts and lectures which have been given here this winter is immense. . . . And yet although musical men are so liberally patronized, it seems as if there were but few persons of good musical taste or even good amateur performers here, at least compared with Philadelphia.

I sigh sometimes for my old friends who garnish the bookcase in the Library [at Northampton], but have to console myself by turning over the leaves of the "Lehrbuch der Chemie" or the "Handbook der Chemie" or the "Manual der Chemie"; delightful variety: bread and cheese, cheese and bread.

Uncle Samuel [Williston, a brother of his mother] and wife are here *in the legislature*, that is to say, the former of the two. Uncle S. has been spending some of his spare dollars in founding the Williston Seminary, Easthampton, Mass. Much good may it do to all our ancestors to come. . . .

. . . I wonder whether the man who was appointed some time ago to make a geological survey of Georgia, has ever done anything; if so, it is entirely unknown out of the state. Can you find out by the asking?

This winter brought to Whitney his first professional success, an appointment to the New Hampshire Survey, at three dollars a day. His duties were of the most congenial sort: to remain in Boston and assist Dr. Jackson with his analyses of the minerals collected during the summer. Unfortunately, this work lasted only through the winter, so that the spring of 1841 found Whitney again without occupation. His father suggested West Point, an editorship, a course of lectures on some popular scientific topic before the lyceums of country towns. The son, on the other hand, favored a trip to Europe, a voyage to the Indies, or in default of these, a trial of his luck as a professional analyst in Philadelphia. What he did do was to march back to Northampton and enter the law office of Charles P. Huntington. There he spent the summer, his mind on the law, and his heart on the New Hampshire Survey.

Josiah insisted that all he learned of the law was how to sweep out the office; but to his family he appeared amply equipped to enter the Harvard Law School and begin the serious study of his grandfather's profession. Toward Cambridge, therefore, in the fall, Josiah dragged unwilling feet.

It is difficult, in these days, to realize the plight in which Josiah Whitney found himself in the early forties. In a very real sense all scientific men of his day were amateurs, either self-taught or trained originally for some other profession. Most of them, like Hare and Jackson, were physicians. Silliman was a lawyer who undertook his professorship at Yale hardly better equipped than his pupils. The practical necessities of medicine had developed the teaching of analytical chemistry; except for this, there was in America no such thing as professional scientific training.

Here then was young Whitney's dilemma. He might look to the law for his bread and butter, and indulge his tastes for science as an avocation. Or he might adopt frankly, as a means of livelihood, the group of sciences which centres around the meeting-point of geology, chemistry, and mining engineering; and be among the first of his countrymen to be thoroughly trained for a definite scientific career. The immediate result of this inner conflict was that Josiah Whitney, on his way to the Harvard Law School, got no farther than Boston.

TO HIS FATHER

BOSTON, *Oct.* 20, 1841.

MY DEAR FATHER, — I arrived safe and sound on Thursday, and on Friday I went out to Cambridge and found [his classmate and college friend, Samuel] Fowler. . . . He told me that the room which I had asked him to engage had been preëngaged. There are, however, rooms on the lower story which would do tolerably well, although rather too cold for comfort in the winter. But as Dr. Jackson has not returned, and as I could not make up my mind to engage a room, which I must keep all winter, before talking with him about my plans, and as I had a number of friends from abroad in the City whom I was anxious to see, I have taken a room at my old boarding place, Miss Lane's, for the present, which I can leave at any time, at seven dollars a week. I had the pleasure of meeting Mr. Lyell, the geologist, and spent an hour with him and his lady last evening, also my old and particular friend Ely, who has just returned from Europe, also some four or five classmates one of whom has just sailed for Europe. I found that it would not be convenient to come in and go out [to Cambridge] in the evening to attend Lyell's lectures; so I concluded that I had better remain here while they lasted, say four or five weeks, and in the meantime I thought I should finish up the drawings for New Hampshire which Dr. J. is anxious to have completed as soon as I can do them. He returned Saturday evening from New Hampshire, and will start this week on Thursday for Maine, where he has a mine to examine. I have been talking with him some in regard to the old subject, the bothering subject, the never decided subject of my profession. He says, "Devote yourself steadily to my profession and you cannot but succeed; true, the outlay will be larger at first, but it is not a crowded profession, you will be sure to find employment when you have studied sufficiently to have confidence in yourself; if your father can send you to Europe, you will have an opportunity to acquire skill which will be almost sure to repay your expense and toil." It seems to me more and more clear that I had better decide to devote myself to the profession which I have already advanced so far in. I can hardly think that it ought to be an unsettled point much longer. You see how the matter stands. I have advanced some way in the study of certain departments of science. I have every reason to think that I may be successful if I persevere. Had I not better make up my mind to persevere and do the best I can? Can you not say, go forward economically, prudently and untiringly, and trust to the future to repay your exertions and expense? Dr. J. would be glad to have me come into his family and work in the laboratory whenever I choose, and as he has now a fine large room in front of the working laboratory where his library and cabinet will be arranged, it will afford great facilities for studying. I can go out to Cambridge once a week and recite if I have time. But first I have three analyses to make, which I must do, as my scientific character is attacked; that is to say, *my new mineral* is said by some to be *not* new, and I am anxious to investigate the matter thoroughly and as soon as possible.

TO HIS FATHER

BOSTON, *November* 7, 1841.

MY DEAR FATHER,—I received your letter yesterday morning, and hasten to reply as well as I can to the matters therein discussed. And first with regard to the total overturning of the plans which I had formed, I have this much to say. That the more I thought of the subject, the more it seemed necessary to me *now* to make up my mind as to my future profession. I had pursued the study of law as far as I could without entering upon the technical part, interesting only to lawyers. The question then was, shall I go on with this study and give up science, or shall I take hold with all my might and go on with my scientific education. You held out some hope that you might be induced to allow me to go on with this, in Europe. It is the opinion of Dr. J. that if I should determine to adopt this profession, I could not fail of securing a living; and when one looks at the vast amount of unexplored and useless (because unknown) deposits of minerals, it seems that [there] would be work enough for practical, intelligent men for a long time to come. I certainly think that it would be in the highest degree foolish for me to enter the law school unless I make up my mind to be a lawyer — and on the other hand, that it would be a deathblow to all hopes of success in science, having made up my mind to follow science as a profession, not to devote my whole energies to that subject and that alone. You ask what plans I have after my return from Europe, and wish to see what prospect there is of my being at last able to lean upon my own resources, a consummation most devoutly to be wished for. To form any definite plans so far forward would be rather difficult, but this much might be said — that I should have accumulated a handsome capital of practical knowledge and that I should be ready to offer it to the highest bidder. In what way I could best use it, or rather in what way the use of it would command a reasonable reward, whether as teacher, lecturer, or practical surveyor, is at present uncertain; but whatever situation was offered me or procured me by my friends, provided I had confidence in my own powers to fill it with success, I should most certainly accept it. But at present, I do not feel the confidence in my own powers which would allow me to accept any situation of responsibility, because I know that I have not had sufficient experience or opportunity of observation to enable me to pronounce with confidence on what I am called to give my opinion on, and for that reason I am unwilling to force myself into notice. . . .

With regard to making a plan for my conduct in Europe, I should be perfectly willing to follow the advice of my scientific friends here, subject to the revision of those scientific gentlemen in Europe to whom I should bear letters. . . But it seems to me that the first question of all to be settled is — shall I go on with my scientific education, or shall I give up in despair of success and try something else? Should the answer be "Go on," I pledge myself, faithfully, untiringly, and economically to pursue the best path which can be marked out for me.

If convenient please send the $50 this week.

TO HIS FATHER

BOSTON, *January* 27, 1842.

MY DEAR FATHER,—I cannot too strongly express to you the gratitude which I feel for your consent to my going to Europe, and I hope that you will not think it from any want of good feeling that I ask your attention to a few words with regard to the time of starting. I must confess that I was not a little surprised that you should say "next autumn." The spring or summer the Dr. [Jackson] thinks to be a far preferable time in which to start. I could find out what was to be done and learnt by a summer's traveling, and where it would be best for me to fix myself for the winter, whether in Paris or at *Stockholm* [where taught Berzelius], if, as the Dr. suggests, I could get into the laboratory of the greatest chemist in the world. But if I do not go till autumn, what business can I find meanwhile to occupy me, what could I reasonably expect for three or four months? My mind would be [so] continually occupied with the thought of going, that I fear I should hardly take hold of anything with my whole attention. Again, to go to Europe

J. D. Whitney, del.

THE FLUME

alone and a perfect stranger would not be very pleasant; but should I go next May, Fowler might and would be companion, and certainly such a companion as he is not to be neglected. . . . But most of all, I shall place most dependence on the skill and experience acquired in Europe for employment here; and of course the longer I delay going, so much do I put off my expectation of a final successful introduction to business and usefulness. I have hastily noted down a few such things as I have thought of, and I cannot but hope you will at least say what reasons there may be to oppose to them to make me wait several months longer. I have been studying pretty much all winter on the modern European languages, so that I may have, so to speak, my tools ready sharpened to go to work with when I reach Europe. I hope you will answer this as soon as you can.

In haste, your affectionate son,

J. D. W. Jr.

Dr. J. desires to be remembered to you.

The outcome is not hard to guess — Josiah sailed on the 9th of May. Before he returned, the report of the New Hampshire Survey was printed: divers portions of it Whitney's and Williams's very own, in which they reported, among other important scientific items, that they two had been the first of mankind to reach the top of Mount Washington on horseback, by way of the Crawford bridle path. Moreover, there were seven full-page lithographed plates of New Hampshire scenery, each marked in its border, "J. D. Whitney del."

CHAPTER III

IN EUROPE. 1842–1847

Samuel Fowler and Josiah Whitney conducted their wander-year like any two serious and well-bred young men. They did the sights of France, Belgium, Austria, Switzerland; they crossed the Alps five times on foot, while Whitney, in addition, made the acquaintance of scientific men and inspected mines along his route.

With the middle of November, 1842, Whitney left his companion, and settled down in Paris for a winter at the École des Mines. Then followed, during the next summer, another tour, through Holland and Sweden to St. Petersburg and Moscow, thence to Germany, through the Tyrol on foot, then Italy once more, ending with a winter in Rome. The spring of 1844 took him back once more to Paris for two months of lectures at the Collège de France and geological excursions with Dr. Jackson's old master and friend, Élie de Beaumont. The summer which followed, Whitney spent at Berlin, in Rammelsberg's laboratory, working over chemical analysis.

With this period, another member of the family group at Northampton begins to replace Elizabeth Whitney as Josiah's favorite correspondent. William Dwight Whitney, eight years younger than his brother, had now grown into a tall sophomore at Williams College, a mighty hunter and collector of birds, a botanist, and a remarkable scholar withal, "as fond of history as of buckwheat cakes." The friendship between the two, beginning as the relation of an elder brother to a younger, soon ripened into terms of equality as William Whitney fulfilled the promise of his student days and became one of the great scholars of the world. The two men were singularly well equipped to aid one another, for they were as unlike in temperament as they were alike in intellect. During more than fifty years, neither brother ventured on any important act without consulting the other. This was the most enduring affection of Josiah Whitney's life: one thing with another, it was the most profitable.

TO WILLIAM DWIGHT WHITNEY

PARIS, *January* 31, 1843.

MY DEAR BROTHER, — I can see you scudding round the corner of the chapel, the thermometer at 0° or some degrees below . . . or perhaps plowing your way through some prodigious snow-drift, pondering on dog-days and ice-creams. . . . And then that popping out of bed so imperatively necessary, groping about in the dark . . . for your lost stocking, trying in vain to break the icy crust of the wash-bowl, or puffing with vehemence at the spark which won't set the pile of green wood . . . on fire. O that getting up in the morning in the depth of winter at 6 o'clock, that dimly lighted recitation-room, that line of half-dressed and unwashed sophs! . . . I don't wonder that your head is so full of your new situation. . . . I like it and I want you to sit right down and tell me all about what happens to be uppermost in your head, especially your studies, your Profs., and your Prex. What mathematics do you study? How do you like them? How much French have you learnt? Can you read it like a book? If you can't, I seriously advise you to read something in that language every day, and *not give up* until you have become well acquainted with it. You don't perhaps yet feel how important it is. No matter what profession you choose, you will be highly benefited by a knowledge of what France is doing in the same; if science be your object, French becomes absolutely necessary. What would you think of a Frenchman who should say that he did not think it would be of much use for him to learn the English language? No matter what you read, read anything that *interests* you; that is the way to learn a language. As soon as you can read French with cleverness, then you must begin *German;* this you will find a more difficult language, but not a whit the less necessary. You need not "go for to tell me" that you have n't time. I know very well how much time the *immensely* difficult studies of College require for their committal to memory! . . .

I am here settled down as quiet as can be, and a regular student, attending three or four courses of lectures, occasionally dropping in to hear Gay-Lussac or some other such illustrious lecturer; in the intervals of time, digging away at Crystallography, Geology, and whatever I can lay my hands on that is interesting.

I live now in quite the Parisian method, breakfast at a café and dine at a restaurant, sometimes in one place and sometimes in another, an abominable way of living. Eating one meal a day I liked very well at first, but I am quite convinced that it is injurious to the health to depend on what is taken into the stomach at one time, to support life.

. . . As for the internal structure and workings of French society, at least in the upper classes, strangers like myself see precious little of it, and I have no doubt that the highest classes of the French are equal to anybody in refinement, delicacy, and education. In what little I see of their scientific men, they appear gentlemanly and modest, which ours do not all of them certainly.

I could make another chapter on the various ways in which a man may dine and in which a man does dine in Paris. Fowler used to threaten to knock me down when I used to hint of pumpkin pies.

FROM J. D. WHITNEY, SENIOR

NORTHAMPTON, *May* 14, 1843, Sabbath Evening.

MY DEAR SON, — I wrote you from Boston May 1st by steamer of that day. . . . I have now only time to give you the substance of my last letter to guard against the possibility that that may not reach you. I have delayed till this time mainly because I have been too feeble . . . to undertake it.

I wrote you that notwithstanding I found no less reason for economy than I had done, I had concluded to consider this as so extraordinary a case that I would make *one last great effort* — and add to what I have already done . . . as needed, $1500, [or in all] $4000. This is to be understood as all I *can possibly do;* and if you think it important to take a journey of exploration West, before you can earn the money to pay the expense of it, *you must reserve it from this sum*, and let nothing further fall upon my shoulders. Since then, I suppose it must be said that your uncle M—— has fairly *failed*, and this throws an additional burden upon me. Tho' the direct loss, eventually, to me will not be very heavy, it causes me great inconvenience and perplexity, and will for some time to come. In addition to this, I shall lose probably $500 or more that I had loaned to your uncle A——, and still further, he and John W—— are both likely to be thrown out of business, and both are writing to me to know what they shall do, . . . and how I can help them.

In this perplexity, I ask you to do something to help me. I ask you to give up your expensive habits, to let nothing be wasted, to dispense with the expensive articles that you would *like to have*, but are not necessary to the successful prosecution of your pursuits. I ask you to relieve me from the burden just as much as you possibly can. You must not say that you are as economical as you can be; every one of your friends, with whom I have conversed on the subject, agrees with me, that your expenses are *much greater* than they need be and ought to be. If they thought differently, I should think I might be mistaken.

I wrote you about the importance of securing and retaining the friendship of Dr. J. I found that Mrs. J. felt hurt by your neglect, and on my return home, I met Dr. J. at the Springfield Depot and had a few minutes' conversation with him. I thought he seemed very much hurt, tho' I trust you have not lost his friendship, and I trust you will hereafter take such a course as to secure and retain it. Bear in mind, how important, how necessary it is to have friends, if you wish to get a desirable and pleasant employment in your profession.

However Dr. Jackson may have felt, he did not let his sentiments affect his zeal for his pupil's interests. He urged upon the father the advantage to the son of translating into English, one or more of the newer German works on chemistry. The two older men entered into the project with energy. Jackson selected several books; Whitney interviewed publishers, who, to a man, balked at the idea of any large work, but thought favorably of a small volume. Finally, the two decided that Josiah would best make a beginning with a short work of Berzelius on blowpipe analysis; and the father, to enable his son to carry out his advice, borrowed and advanced on the copyright enough to keep the young chemist three months longer in Berlin.

TO HIS SISTER ELIZABETH

BERLIN, *May* 24, 1844.

MY DEAR SISTER,—Imprimis, let us rejoice together over the new Piano—I take it for granted that it is a good one, that it is in good tune, and that its ivory keys are fast becoming acquainted with the ends of Miss Sarah's fingers. . . . Is it long, grand, square, upright, soft, loud, tinkling, wiry, cottony, plain, ornamented, mahogany, rosewood, or what is it? . . . Did the inhabitants of Northampton form a procession and go forth to meet it, and escort it triumphantly up the Rue du Roi? [i. e. King Street.] I should certainly have done so had I been at home, fiddle in one hand and guitar in the other. . . .

. . . How well I remember when I first became the possessor of a little flute, sixteen years ago; how the tears rolled down my cheeks with delight as I retired to the barn to give vent to my feelings in the two only notes which I could produce on my instrument, which I will venture to say was regarded by the rest of the house as anything but a magic flute. Hum, I dare say that I enjoyed my own squeaking of "Auld

Lang Syne" as heartily as I have since the silver tones of Tulou's flute, so clear and sweet amid the pianissimo of an orchestra of a hundred masters. Have I not heard music of every kind and variety, since I have been abroad? The last wonder, however, when I left Paris, was Liszt, the pianist, the Paganini of the piano; never did musician make a greater excitement there, and never was a reputation more brilliantly deserved. Who but Liszt can make the piano sing, laugh, thunder? His soul is in his fingers' ends, and he seems to feel every note as if the piano were a living part of himself; certainly among the wonders of this generation, Liszt is one.

But after all, the piano is but a limited instrument; and when I listen to such a performance and see the writhing and contortions of the performer, it seems to me to have too much the air of a *tour de force* and leaves (with me) an uneasy sensation at the bottom of the pleasure. I have never enjoyed any music abroad so much as the chanting in the Russian churches, especially one night in a Convent near Moscow. The Russians are naturally musical. Many of them have delicious voices, and there is a plaintive expression about their airs which charms and softens. Moreover, they spare no pains or expense in the cathedrals of Moscow and St. Petersburg, and a remarkable voice cannot be too dearly paid, or too sharply contended for between the choirs of these two cities. The singing is all by male voices, and to exaggerate the effect of these low, wild, and admirably harmonized chants, sung by the clearest and richest of voices in the softest tones, never rising above piano, would be impossible. I have heard high mass in the cathedral at Dresden sung by all the artists in the city, attended by an imposing orchestra, and seen the elevation of the host amid the rolling of the drum and the clang of the trumpet; but the effect was as nothing compared with those low, soft notes which filled the whole soul with their melody.

But enough in all conscience of music, though, as I am at *Berlin*, I have a sort of a right to talk on that subject. . . . A month ago I was a *Frenchman*, now I am doing my utmost to make myself a *German*. I have not a single English or American acquaintance here. Very few Americans come here; few even pass through the city, and fewer still remain here more than five days. . . .

Berlin is, [of] all cities, in any other than a scientific, literary, and musical point of view, the most disagreeable in Germany. Imagine a city of 300,000 inhabitants, in the midst of a vast sand plain, without a hill of sufficient height to break the monotony of the view within 200 miles! . . . But then it is the residence of the Court and the seat of a University which may well boast of an unrivaled set of Professors; especially is the corps of Science strong. There is *Humboldt*, the *doyen* of scientific men, Von Buch, Ehrenberg, the two Roses (not the white and the red), Rammelsberg, Weiss, and many others whose names are not so familiar the other side of the water as they ought to be. What a grand chance to study; a dull city where there are few things to distract the attention, learned profs. in abundance, willing to impart their knowledge for a trifle, no acquaintances to bore one and steal away one's time, inhabitants reputed inhospitable etc.; what other city unites so many advantages? So let us buckle to and work as fast as possible so as not to be discontented that I have not *one solitary friend* to converse with, and that I must put my mother tongue on the shelf for an unlimited time, having really no other use for it than occasionally to write and read a letter from you or from Father, or to read the Bible which is the only English book I have in my possession. . . .

I ought to tell you about the famous Exposition at Paris, to see which I remained several days at Paris; but I despair of being able to give you any idea of its magnificence. . . . But if you had been there, you would have wondered at the productions of the Lyons looms, the silks, the satins, the velvets, etc., the jewellery, the plate, the potato-parers, the porcelain, the stocking-weaving machines, the elastic and miraculously fitting corsets . . . but stop, for particulars see small bills . . . suffice to say that a Northampton cattle-show and fair . . . could not present a more imposing display. . . .

I declare that if you let anybody but Sarah read this letter, you will not conform to my wishes.

If Josiah could have had his own way, he might have remained abroad indefinitely; but his family wanted him at home. Elizabeth complained that because of her trip south, she had not seen him for five years. William wrote that when Josiah went away, he was not even a subfreshman and now seemed likely to graduate before his brother's return. His father, who had already advanced five hundred dollars on the copyright of a book not yet begun, ordered him to complete his arrangements with his author, "and then make your way home as fast and as economically as you can. . . . It would give me great pleasure to support you at Berlin longer if I could afford it, but after my losses by your Uncle M——'s failure, and with so many children, brothers and sisters and cousins, that need my help and whom I feel bound to help, and whom I have helped so much already, with other losses I feel *poor*." . . .

Home, therefore, Josiah came and reached Northampton during the second week of January, 1845, after an absence of nearly three years.

With him came three hundred and forty-one volumes, additions to a library already ample for a youth barely twenty-five. There were, as might be expected, all the more important works of the great European chemists, Rammelsberg, Rose, Berzelius, Fresenius, Liebig, Poggendorff. On the other hand, there were curiously few works on geology,—Burat on volcanoes, a volume of Cuvier, a handful of books on glaciers; and besides these, a half-dozen volumes on other natural sciences, with two or three more on mathematics. More than half the library was general literature, Jean Paul, Lessing, Uhland, Heine, Schiller, Grimm, Spinoza, Dante, Machiavelli, Boccaccio, Madame De Staël, Racine,—one could go on for some time with the list. If Whitney had spent freely, he had also spent wisely. There were, besides, grammars and lexicons for French, German, Swedish, Danish, Norwegian, Russian, Dutch, Spanish, Italian, Icelandic. Most important of all was the Sanscrit Grammar of Franz Bopp, whose lectures Whitney had attended in Berlin. That book was an expansion of mental horizon to Josiah; for William it proved to be the call to his life's task.

TO WILLIAM DWIGHT WHITNEY, AT WILLIAMSTOWN

[CAMBRIDGE], *April* 6, 1845.

What on earth they wanted to locate a college up among those hills for, I can't conceive; the most astonishing part of it is that they find students to stay in such an out-of-the-way corner of the earth, when they might come down to Cambridge and become members of the greatest University in all creation. You must know that I have advanced a step in life; I have acquired new honors and shed immortal lustre on old Harvard by becoming a Resident Graduate. That is to say, I signed a piece of paper binding myself, my heirs and executors forever, to pay One Hundred Dollars in case I should run off with any of the books which I expect to obtain from the College Library, say an old Indian Grammar or two and a musty history of New Hampshire. . . . Having been here more than a fortnight, I may consider myself at home, especially at the table, where I do prodigious execution among the muffins and baked apples, no doubt much to the dismay of those who feel a deep interest in the motions of my knife and fork.

There are seven of us, three tutors, one law, and one divinity student, with the Editor of the "North American" [Francis Bowen], and myself a student of nothing in particular and a practitioner of nothing in general. A right good set of fellows they are, and many a good joke and bad pun circulates with the fish and potatoes. (We are all Yankees.) It is forbidden to talk Greek or quote Patagonian, so that, although we are very learned, no one would suspect it to hear us talk. I might add that we are strong anti-teetotallers — at least in theory — and that we consequently are always betting champagne and other intoxicating liquors, which bets are never paid, so that we never have a chance to act up to our principles by getting under the table. The weather has been delightful lately; and were it not that the dust is always flying, and that the livery-stable horses are melancholy proofs of the unscientific treatment of undergraduates, one might enjoy a ride horse-back occasionally. As it is, I content myself with walking into Boston almost every day, especially as Lizzie is there, and I have no regular business, as my printer has not got to work yet on that Blowpipe book. When I first came down, he said he would have it printed in Cambridge, so I thought that I should be at hand to correct proofs; but all of a sudden, after I had moved out here bag and baggage (i. e. trunk and umbrella) he said the Cambridge printer was not the man, and that it should be printed in Boston. Then he must have it printed with new type, and they have had to be cast and ought to be done before this time; then, there are no type in the country for printing chemical formulas, and they must not only be cast but cut, and there was a mess of trouble and an expensive job too; so I have not been near the printer for a week and think it very likely that he would like to back out of the whole scrape if he could. . . .

I expect to go to the geological meeting at New Haven on the 30th of April and remain a week, if I can get away from printing and correcting proof sheets; and I suppose I shall have to return here after that, as I shall not have finished printing. . . . Anyway I shall probably be at home in your vacation, if it lasts long enough. . . .

You say you want some advice about how to spend your time after you leave College. Ask *me* for advice, do you? I feel proud, nobody else ever did me that honor . . . I must be getting ancient and respectable. You must (to speak seriously) write me *what your ideas are* (that 's what Father always says, when he don't feel competent . . . to enter into the matter), and I will sum up and give you my decision, from which you can appeal to the common sense of the family.

It happened during the three years of Whitney's stay in Europe, that Dr. Jackson had been exploring the copper and iron mines of the Lake Superior region. He was not the actual discoverer of the mineral wealth of northern Michigan, but he was among the first to appreciate the richness of the deposits, and to make them known to the scientific and industrial world. Naturally, then, Jackson became consulting expert for several mining companies, a service for which he exacted twenty dollars a day, half in advance. The less attractive portions of this highly profitable work, Jackson was able to throw in the way of his pupil; who in consequence, after "Betsey on the Blowpipe" was finished, spent July, August, and September in the field, as geologist for the Isle Royale Copper Company.

Mining on a large scale and by any other than primitive methods was then a new industry in the United States. Jackson, therefore, continually urged his clients to send to the mines of Saxony and the Harz for skilled workmen and furnace masters. Hardly less continually did Jackson recommend Whitney for the commission. Besides this, Jackson was consulting chemist for the Cocheco calico print-works of Dover, New Hampshire, and was, therefore, in a position to pay well for exclusive information as to German cotton cloths. This also he turned over to Whitney; and between the two commissions, with some added help from his father, Josiah went abroad once more, in December of 1845.

From Berlin, where he had been since the beginning of the year, in the laboratory of Heinrich Rose, he wrote to his brother William, now clerk in their father's bank at Northampton.

TO WILLIAM DWIGHT WHITNEY

April 25, 1846.

. . . .

You do not tell me how you like the Bank, or what your plans are about continuing there. It seems that you have quite given up the idea of studying medicine. I want you to tell me just what your ideas are and what you think Father's wishes and expectations are, in regard to this important matter. Of course my first object will be, as soon as I return, to do all I can to have you enjoy any advantages, which you may wish, in carrying out your education. If, as you proposed, you wish to devote yourself to the study of Philology, and take a Professorship, you must come out here and remain at least three years. I only wish that you could come out while I am here, so that I could see you fairly started in your course of study, and I do not see why it is impossible. My plans are, to go to New York, as soon as I get through here, and open a laboratory, where I have good reason to believe I can "do a handsome business"; that is to say, if I can condescend to a little quackery to start a name and a reputation.

I should much prefer Boston to any other city as a residence, but there seems to be little chance for me there. Boston has a much more refined and literary society than New York, and it is the only city in America where anything of any account is done for science, and where there is anything like a body of zealous naturalists. I suppose I should be run after for a Professorship, if I had studied at Giessen, as it seems to be a settled point that no young man can be expected to know anything of chemistry, unless he has studied with Liebig;

while the truth is, that any one who goes there and does not afterwards correct the bad habits acquired there, in some other laboratory, is almost unfitted for doing any thing in Chemistry. No doubt Liebig is a remarkable man, who has done much for organic Chemistry, not to speak of his having quarreled with all the Chemists in Europe; but, that his genius can communicate itself to his pupils by his merely looking at them once a day, I do not believe. It must be a curious sort of place where fifty or more chemists dine together, and discuss the last new Liebigschen theories with *Sauer Kohl* and *Bairisch Bier* ad libitum.

Still, Liebig had the best teaching laboratory outside of Paris; and there Whitney repaired for the winter of 1847. There, too, began his lifelong friendship with the great chemist, Wolcott Gibbs.

TO WILLIAM DWIGHT WHITNEY

GIESSEN, *January* 26, 1847.

. . . .

You know by my last letter to Father, that I came on to Giessen at the beginning of the Semester, and you will have to take my word for it, that I have been working from morning to night ever since, excepting now and then an occasional breath of fresh air on Saturday afternoons. One day is so much like another, that if I give you a description of one, it will answer for all; and you will be able, by allowing for difference of longitude, at any time to give a pretty good guess as to what I am doing. I try desperately hard to get up at six o'clock, at which time I am always awakened by the servant-maid as she comes up to make the fire; if the thermometer is much below zero, I think about it so long, that it sometimes gets to be seven before I am fairly on my legs. At seven precisely, coffee is ready, down to which I sit, generally with Berzelius in my hand. The breakfast consists of coffee with the inevitable two *brödchen*, which are of the kind and size which the apothecaries might well sell for eye stones. While eating them, I think of oysters and fried pudding on alternate mornings, and so, with the aid of a little imagination, get on very well. As I am thus engaged, in comes the *Stiefelputzer* with his invariable "Guten *morchen*, Herr Doctor" (all Chemists here are ex-officio Doctors, I suppose), makes his report on the weather, which is generally "fürchtbar kalt," or "schauderhaft nass," and vanishes after a feeble effort to make the boots shine with a composition unknown to Day & Martin, and a few speculations as to the many colored spots in the unmentionables.

Breakfast over and boots on, I rush for the laboratory, and generally manage to be the first there. Here we work until dinner time, half-past twelve, when we all march into town together, and dine; back again to the laboratory, work till six, home, a cup of tea, study and write till eleven or twelve, tumble into bed and sleep like a log till the next day's work commences again. One night in a week, a few of us come together and discuss matters and things in general, drink a friendly cup of tea, play a quiet game of chess or whist, and make up for six evenings of quiet and hard work by one of good hearty fun. We have some good fellows here in the laboratory among the numerous specimens of all lands and nations, dialects and tongues, chemists of all sorts; for ours is the laboratory where Professors and Doctors are manufactured to order. There is nothing which does not get hauled over the coals with us. Gibbs and I are working at sheep's bile and a new substance obtained by subjecting the flesh of an old horse to a fusion with caustic potash. Our next neighbor regales us with the odor proceeding from a quantity of eggs in a very advanced state of decomposition, dried blood, etc.; another has the monopoly of all the eyes of the animals slaughtered in the village; another has a quantity of very strong cheese, out of which he is getting all sorts of curious things; and so through the whole forty or less of us—and such a mingled mass of odors as rises up from the laboratory, it is well that it is a good distance from the town, or the inhabitants would have risen up and driven us out, long ago.

There is a great deal of work done here, and a great deal of money spent in a year, in all the investigations which are carried on. The Professor himself spends a large amount on his own work, and has a special assistant to carry out his analyses, etc., for him, besides the two who have the general oversight and care of the laboratory. The Professor generally comes round and speaks with each of us, both morning and afternoon, enquires what we are doing and gives his advice gratis. At first his ways and manner did not strike me very pleasantly, but now I do not mind so much about him, as I did at first. He has a terribly sharp eye, with which he bores you through and through, when he speaks to you, and all together he is a man whose whole appearance is one which commands and interests. I should want to be here a long time to fathom his character. Out of the laboratory I do not know a soul in the town. The people in whose house I live, I never see, though I am told they are a very good sort of folk. Every now and then I hear a piano going on downstairs, from which I conclude there must be women-kind about, though I see nothing of them except a very stupid *Mädchen*, who almost tires me out by her awkwardness and sluttishness. I have not been able, to this day, to teach her how to fill and trim my study lamp, which she still looks at with very much the same feeling of awe and astonishment that a small boy with us does on a big steam engine, for the first time in his life. . . .

Think of a town of 10,000 inhabitants and no newspaper, no *bank* and no banker, no public amusements of any kind whatever, and every other man a *Rath!* German from top to bottom. The situation, however, makes up for all; it must be beautiful in summer — to be sure, that does not help me much, being only here in winter.

There are several curious, conical, volcanic-looking, basalt hills around within a mile or two, crowned with the remains of extensive and famous old strongholds, real castles of the feudal ages, with their solid walls and high towers, around and under which clustered the inhabitants in their cottages for protection, on the sides of the hill, in the most picturesque and curious way. Then the geology of the country round is interesting and there is much here which puts me in mind of the valley of the Connecticut: the same rocks and something the same contour of the hills. The valley of the Lahn all the way down to Coblenz is said to be charming. Only think! if it were summer, what a nice thing it would be to tramp away for a week or two and leave the old horse to take care of himself, and cruise up and down the Rhine, among the Castles and Vineyards. But it is winter and such a winter! first of all rain, then rain—snow—thaw; snow—thaw—rain. One day in December we caught a few inches of snow, whereupon we started up a sleigh-ride, and drove off to Marburg [about seventeen miles] to visit Professor Bunsen; before night, it began to rain "what you call" pitchforks, and we had the satisfaction of coming home on bare ground. Then came a cold snap, and the thermometer actually went down to some −15 Réaumur [two below zero Fahrenheit], and what's more, hovered about that point for nearly a month; then we had some pretty good skating (by the way, they understand harnessing skates better than we do). Last Friday, the snow fell about eight inches, and a capital article for snow-balling, and such a time as we did have! Never did schoolboys so bepelt, bespatter, bedaub, so besnow each other, as did the grave and reverend doctors of the Giessen laboratory. We got all the machines on runners that we could find in the village and drove to Wetzlar [about seven miles away]; at every village on the way we fought a pitched battle, set the village into an uproar, frightened all the old women and cats out of their senses, and cut up such capers as boys crazy for fun are wont to do. "Die Schlacht bei Dudenhofen" (the next village to Giessen) will be as memorable in the annals of the town as that one which General Taylor is going to fight with the Mexicans, and which we have been expecting to hear of by every steamer, for the last twelve months. . . .

I am glad that you have taken hold of Swedish; you will not have been long in exhausting my library in that department. If you have read all the *Årsberättelser* through, you shall have two new ones to read, when I get home. In the meantime don't forget, that if you are coming to Europe, *French* is the most important language, and you must be able to speak it fluently.

FROM J. D. WHITNEY, SENIOR

NORTHAMPTON, *April* 23, 1847.

You must hurry home to be here before our family is entirely broken up. Come prepared for great events. It is as true as strange, that

Elizabeth and Sarah are both *engaged!* The former to Mr. Putnam, a forwarding merchant at Milwaukee, the latter to Rev. R. C. Learned of New London, a young, unsettled minister. Both within a week of each other. . . .

With his return to Northampton early in May and the weddings of his two sisters, the period of Josiah Whitney's education comes to an end. Thanks in about equal measure to his father's generosity and to his own industry, there was no better trained young man of science in the country.

CHAPTER IV

THE LAKE SUPERIOR SURVEY. 1847–1850

THE famous copper district of Lake Superior begins at the tip of Keweenaw Point where the Upper Peninsula of Michigan makes out into the lake, and extends in a narrow band parallel with the shore, some hundred and twenty miles southwest to the border of Wisconsin. The metal-bearing strata dip toward the north, pass beneath the waters of the lake, and reappear fifty miles away on the other side of the great trough, on Isle Royale. There is copper also on the Canadian side both of Lake Superior and Lake Huron. Southeast of this copper belt, near the middle of the Upper Peninsula, lies the iron district.

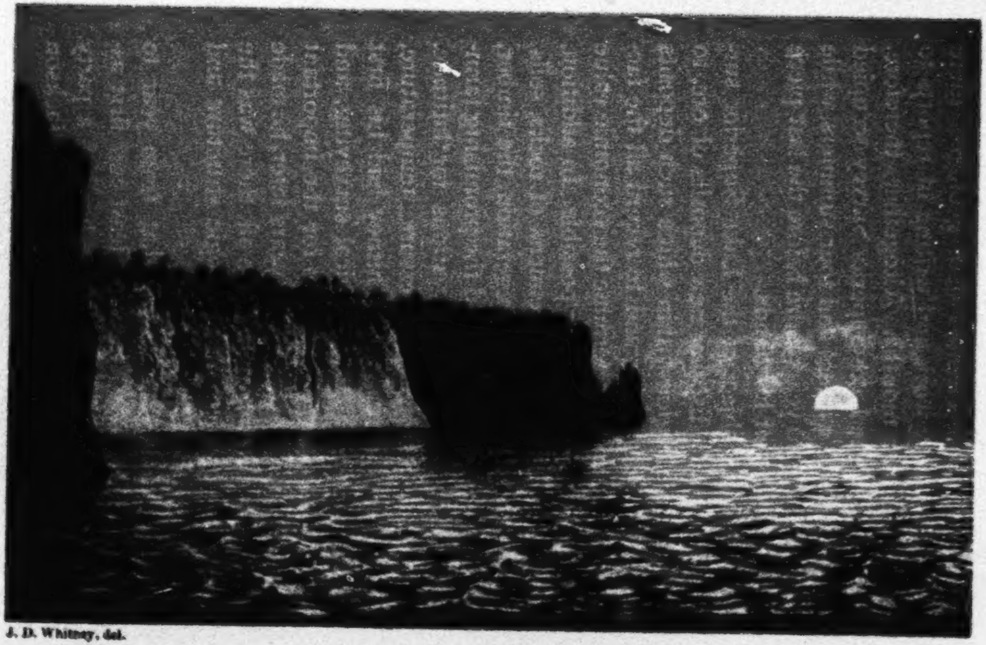
This whole region was an unexplored wilderness in the forties. It had been ceded to the United States by the Chippeways in 1843, after Michigan became a state, and in consequence belonged to the General Government. When, therefore, after the "copper fever" of 1845 and 1846, the Upper Peninsula appeared to be settling down to a normal development, it became imperative that the usual survey of the General Land Office, which divides a district into townships and sections, and was already under way, should be supplemented by a geological survey, for the laws which govern the distribution of the public domain distinguish sharply between mineral and agricultural land. Such a survey, in charge of the Treasury Department, Congress ordered in March of 1847.

The natural head for the new survey would have been Dr. Douglass Houghton, State Geologist of Michigan, who had made a beginning at the task. Houghton, however, in the fall of 1845, while at work on the geology of Keweenaw Point, was caught on the lake in a snow squall and drowned; and the appointment, in consequence, fell to Dr. Jackson. Jackson at once offered Whitney, who was still with Liebig at Giessen, an appointment as a First Assistant, at five dollars a day, with charge of a district as large as the State of Massachusetts. Up to this time Whitney had been fitting himself to become a chemist; Jackson's offer made him, in the end, a geologist.

Nominally the appointment was for only five months of the year, from the opening of navigation toward the end of May, until late in October, when it became no longer safe to remain in the wilderness, if one expected to get out again before spring. For Whitney, however, still more chemist than geologist, there was laboratory work and writing of reports to fill the winter months. Altogether, therefore, the work of the Lake Superior Survey occupied him for three winters and four summers, while it was fully two years more before the last piece of work was off his hands.

The main object of the Lake Superior surveyors was to discover new deposits of ore, to delimit the region within which such deposits were likely to occur, and to record all the factors which might determine the economic value of any mine, new, old, or possible. In addition, they were to collect specimens of rocks, soils, and fossils; to note the vegetation, the timber, the harbors and rivers, and the promising farming land; to make observations for latitude, longitude, barometric pressure, temperature, dew point. Here, also, Whitney had his first experience with topographical surveying, and here he laid the foundation for the important contribution which, twenty years later, he made to this backward art. Above all, there was the scientific problem, the geologic structure and age of northern Michigan.

The party varied somewhat from year to year. There were always at least two first assistant geologists, each at the head of a party and responsible for his own district. Jackson



J. D. Whitney, del.

SAIL ROCK, LAKE SUPERIOR

himself kept general oversight, and watched the appropriation bills at Washington, but did less actual field work than his subordinates. William Whitney went out in the summer of 1849 as botanist, ornithologist, and clerk. Wolcott Gibbs was also of the party; and Charles A. Joy, Whitney's fellow-pupil under Jackson and afterwards professor of chemistry at Columbia and editor of the "Scientific American." So too was Dr. John Locke, the physicist; and Dr. William Francis Channing, a son of Rev. William Ellery Channing, whom Whitney had known in Jackson's laboratory and on the New Hampshire Survey; and John Wells Foster, who afterwards became president of the Chicago Academy and of the American Association. Whitney counted as an experienced man, by virtue of his connection with the New Hampshire Survey, and he knew the country from his work there during the summer of 1845. Locke, an older man than the rest, had been on the United States exploring expedition to the Northwest Territory, and on the first state survey of Ohio in 1836 and 1837. Foster, a lawyer and civil engineer as well as geologist, had also been on the Ohio Survey with Locke, and, like Whitney, had come into the Lake Superior region with the rush in 1845. In general, there were besides Jackson and his two first assistants, five or six other geologists, mineralogists, naturalists, or surveyors on salary, an accompaniment of packmen, boatmen, and cooks, mostly Indians and Canadians, and a varying number of beginners who served without pay for the sake of the experience.

The account which follows of Whitney's second summer in the Michigan wilderness, and of the winter which succeeded it, is condensed from his home letters to his brother at Northampton. In brief, the entire party went first to Copper Harbor near the tip of Keweenaw Point, where there was a United States fort, and where the expedition made its headquarters. Thence the first assistants separated to their special fields. Whitney, in addition to keeping his subordinates employed, himself traveled back and forth somewhat freely, picking up loose ends of work, preparing for work to come, interviewing miners, comparing notes with his associates, and going over old ground in the light of new discoveries. He took the western side of the district and Foster the eastern.

TO WILLIAM DWIGHT WHITNEY

SUNDAY *June* 25, 1848.

I rode all night on Wednesday and the next morning joined Dr. J. and party at Syracuse. . . . I was not much fatigued as the cars were not crowded from Utica on; so that by dint of getting possession of some four or five seats, and curling myself up into a W, making a pillow of my coat, I managed to remain in a torpid semiconscious situation till breakfast time, despite the amorous occasional punches of the conductor, who seemed bent on finding out how a man could manage to be so very quiet in such a curly kind of a position. . . . We reached Buffalo late on Thursday night, and I went to bed, quite ready to make up for my long journey by a good night's snooze, which happily even the rattling of all the pots and kettles . . . in the kitchen, two feet from my window, did not break up till exhausted nature had secured for herself a sufficient dose. We started off after breakfast for Niagara, as no boat left till evening . . . took leave of civilization and good dinners for an indefinite period . . . went on board [the boat for Detroit], and were out on the Lake soon after 10 o'clock. The boat was crowded with German emigrants above and below, of all sorts and kinds. I never met so many ill-favored and repulsive looking people on one boat in my life before. . . . But to make up, the religious war was carried on most furiously. From morning to night, there was a set of some twenty in the main cabin going it hammer and tongs; one of whom I am sure repeated the whole Bible through at least three times in the course of the two days. If the voyage had lasted another day, I am confident we should have had a pitched battle and bloodshed. Thirty-six babies crying with most lusty voices were hardly heard in the din of the discussion; add to this a temperature of + 96°, and 196° over the boilers where our stateroom was, and you may perhaps appreciate our situation. . . . I expect to leave my poor perspiring corpse in drops between Buffalo and Copper Harbor.

[Beyond Detroit] boats run with the most desperate irregularity, so that we must depend on [two little steamers] which run from the Sault to Cleveland when they can find nothing better to do, which luckily this year is not so easy as it was last. . . . Times are not as they used to was in '45, when all Yankeedom and no small portion of Christendom were hurrying up to Copper Harbor, and every boat was crowded, and every single passenger had a permit in his breeches pocket and a license to dig out unlimited wealth from the bosom of the El Copperando of the West. [While waiting at Detroit] I shall be mostly occupied in rating our chronometers (of which we have prevailed on our Uncle Sam, who is desperately chary of giving his boys watches to play with, to give us two), determining our longitude and latitude, adjusting and comparing instruments, and snoozing away the heat of the day to the tune of "Heigh ho! when is that boat a-coming?" a tune which I have drawled out my share of already, I think, on these lakes. . . . You will think that we shall hardly get to Copper Harbor before we shall have to look round for a chance to get back again.

[The party, after a week's wait at Sault de Ste. Marie, found a sailing vessel to take them to Copper Harbor.]

We had a pleasant run of 36 hours from the Sault to this place with a six-knot easterly breeze and the lake quite smooth, which I put down as a lucky omen, since I believe I never navigated the Lake before with a fair wind. [Professor Louis Agassiz has a party in the region] which is now somewhere on the northern shore of the Lake, if not at the bottom of it. They are some 15 or 20 naturalists and Cambridge students on a tour of scientific pleasure, and we arrived at the Sault just in time to see them off. We were much amused by their evident *verdancy* in regard to a life in the woods. Nobody was captain among the 30 men and voyageurs; and when anything was to be done, the only way was to put it to vote, a precious situation to be in, if overtaken by a squall in making a long traverse. After being fairly gone a couple of days, when we supposed them fifty miles off, they sent back a boat for a dozen earthen bowls, which they had discovered to be better coolers of coffee than their tin ones! I should love to see them in camp and watch their proceedings.

I remained at our headquarters . . . while all the rest of the crowd went round and over the point to Lac la Belle and back. I had the chronometers to rate, and some observations to take and calculate, which kept me busy. The weather was delightful, the moon being full and the evenings clear and cool; if any of us had been of a romantic turn of mind, we should have gone off the hooks in a fit of extasy—especially the other night, when we were treated to a brilliant exhibition of the "sparks flying off the north pole"—but it grieves me to be obliged to say that some ice-creams which were manufactured at the Fort, and of which we were invited to partake by Mrs. Hawes, excited more enthusiasm than all the moonshine and aurora together.

We shall probably leave toward the latter part of the week for the Ontonagon. . . . We shall have rather a hard time this next month, but after that the worst of the flies will be over. . . .

My party will consist of Dr. Gibbs (fate seems determined to throw us together; we always passed for one person in Berlin and Giessen, so constantly were we together, namely "Gyps-und-Vitnei"). [The two men really did look somewhat alike.] Also Mr. Joy of Ovid, N. Y., and three or four good men. We shall first go up the Ontonagon and take another look at the country, see what has been done during the winter, determine a few points astronomically; then to the Porcupine Mts., measure their height (which we could not do last summer, as we had broken our barometer before getting there), examine one or two points of interest on our way back between the Portage and the Ontonagon. We shall return to Copper Harbor in about five weeks. . . . Thence we shall take a fresh start, probably in company with Mr. Foster and his party, and explore south of the bay at the south of Keweenaw Point through to the Menomonic River, and I presume that . . . we shall not return to Copper Harbor again. . . . Coming back to Copper Harbor [would, however,] be an agreeable relief to the monotony of the season, and we [should] be able to find a few letters and hear what has been going on, instead of being shut up all summer long in the woods. . . .

Having at last got everything ready, we

started off under a pressure of white-ash canvas, with three cheers from a solitary spectator assembled on the wharf, about 5 o'clock P. M. last Friday; but had not gone far before we were overtaken by a most violent thunderstorm, while the rain coming down, as if they had just finished their Monday's washing overhead and were emptying out the tubs on us, soon gave us the pleasing prospect of being wrapped in wet blankets, if not in wet sheets — a hydropathic method of treatment admirably well calculated for assuaging a romantic love of wandering, which torments some people. We soon got ashore and camped as well as we could, considering that it was our first night out, and everything new, and all hands unused to each other, so that nobody knew what his share of the work was. Our tent was new, and when we came to pitch it, we found that all the pitching in the world would not make it mosquito- if it would water-tight. For the flap around the bottom was about three inches too short — an arrangement well calculated to promote ventilation, to be sure, but as mosquitoes were very thick, we were decidedly opposed to leaving so large a crack for them to crawl in at. So we stopped it up with branches of trees, and putting no admittance on the door in Indian and French, we proceeded to partake of a bountiful supper prepared by our French cook, whom I had engaged at the Sault, he having left his former master, because he had publicly put salt in his soup, I presume. I am decidedly luxurious this summer, having three first-rate men (two packmen, one cook, and three boatmen), and also two pleasant companions.

We reached [Ontonagon], the capital of my district and my seat of government, last night, and found it very much as last year — the mosquitoes not quite so bad perhaps, but some other things worse. The mines in this part of the country are nearly all abandoned; and even the farce of "keeping the location" (in a case where there was no prospect of the location ever producing enough to keep you) is given up. None of the men employed by the companies in this part of the world have ever got any pay, such being the fashion here from the beginning, and still strictly adhered to; so you may imagine that ready money cannot be very plentiful. Yet they have been beating each other's empty brain-cases in, and making shot and bullet holes in each other, all about the preëmption-right to a parcel of land, which not one of them has got the money to buy, and which is not worth a cent anyway.

Thus far I had written when on looking at my watch, I found that it was nearly ten o'clock — which was such an unprecedentedly late hour to be up, that I was quite frightened. We are waiting here still, [with] Mr. Foster and his party, for Mr. Hall to come back from Eagle River with some "tin" . . . to pay off his men with, when he reaches Green Bay. The rest of us are waiting for the arrival of the propeller from Isle Royale, with two of the corps, who have been imprisoned there during the summer. Since I wrote the first part of this letter, we have changed our plans a little. As it stands now — if we do not change again before to-morrow, which I hardly think probable — I shall take the "Chippeway" or some other small craft, with the necessary instruments, and accompanied by Mr. Joy, shall proceed to Isle Royale, to fix its position astronomically, and measure a few sections across the island barometrically; in short, to finish up what is yet to be done, before the final map of the island can be drawn. This will be a very agreeable little trip. Meanwhile Gibbs will take my party, and go on with the work where I was intending to go before; and if I get through in time, I shall join him, and give a final look at the country above the Portage, before leaving. This, however, I hardly expect, unless the weather and wind favor us extraordinarily.

TO WILLIAM DWIGHT WHITNEY

BOSTON, *December* 11, 1848.

MY DEAR WILL, — I have been as busy as possible ever since reaching Boston, as Mr. Foster is here and we have had a great many matters to talk over together. California is all the rage now, and poor Lake Superior has to be shoved into the background. We are already planning to secure the geological survey of that interesting land, where the farmers can't plough their fields by reason of the huge lumps of gold in the soil. In consideration of all of which, I want my copy of Duflot de Mofras's book on Oregon, California, etc. with the plates, which are in one of the drawers under the bookcase in the library. . . .

I shall drive away to finish the chemical work I have to do now in three or four weeks; and shall then commence writing my report, which will occupy me a month or two longer — then I mean to have a vacation, and do something dreadful in the way of recreating.

TO WILLIAM DWIGHT WHITNEY

January 3, 1849.

. . . I believe I quite forgot to say, in my last, that I had moved back to my old boarding-house, No. 4 Bowdoin Square. . . . There was a very pleasant room vacant, and the situation being so convenient to the laboratory, I thought I had better walk in and take possession. So now I am very comfortably settled, and if I could get rid of these diabolical headaches, I should be accomplishing a good deal in one way and another. I am glad to say that for the last few days I have slept pretty well, my turns of headache coming on generally about 8 P. M. and disappearing mostly by 9, or 10, or 11, or sometimes 12. I can't bear to go to Dr. James Jackson, in whose advice I should put the most confidence, for I know perfectly well that he would tell me to refrain from reading, writing and thinking, which I cannot do, at least at present. Unless I am down sick, I shall stick by, and work a little at least, and trust to luck to get better by and by. Such turns do not generally last more than two or three months.

There is nothing particularly new about California. One of my friends received a letter from Mr. [Robert C.] Winthrop the other day, in which he did the handsome thing — promising to back me up with the strength of his influence. I find that I have a good many strong friends scattered about here and there.

TO WILLIAM DWIGHT WHITNEY

BOSTON, *January* 24, 1849.

I made an ineffectual attempt to write you last Sunday, but at the end of the second page I concluded that it was no use to try to write when one did not feel like it. So I very deliberately rolled the letter up into lamplighters and should undoubtedly, had I not left off smoking, have lighted a cigar with one of them and sat me down to ruminate on the mutability of human affairs. Time is wagging along, and I have been so busy that I have hardly had time to notice its progress. But here we are at the end of January almost . . . May will soon be here, and I dare say you will welcome it, hey? . . .

I do not see but that you will have to go up to Lake Superior after all, for it seems to be the general opinion that there will be no survey of California organized this session at least. I don't care about having the thing done at all, unless it can be got up in good style, a regular scientific exploration of the whole territory, the results to be published in handsome style, and not on the filthy wrapping paper which answers well enough to embalm the stale speeches of the M. C.'s. I wrote an article of two columns for the last "Mining Journal" (if I had a copy I would send you one), stirring up such a survey, and I mean to follow the attack up in that journal, in the "North American Review," and "Silliman's Journal." I shall begin to go to work in earnest as soon as my Lake Superior report is off my hands. That takes up all my time, and I shall not feel easy till it is finished. I sent off to the printer yesterday, an article for the next number of the "Journal," of thirteen pages, which I have been working on nights and mornings, and at odd ends of time. I am going to draw up a plan of a survey of California and Oregon, and lay it before the American Academy; they will endorse it and send it on to Washington, so that that will be a good stepping stone, I think, to an appointment, if the survey is started.

TO WILLIAM DWIGHT WHITNEY

BOSTON, *March 7*, 1849.

By some strange fatality your letter of February 27th was only delivered to-day. I had been wondering that I did not receive a letter from you, and could find no other reason than that you were so *set up* by your success as a lecturer, that you had concluded not to own relationship with common beings like myself. You must never accuse me of not thinking of you; you would have to scrabble round a long time, I am thinking, to find anyone who loves you as well as I do, or who would value your affection more highly. I must confess that I have felt a little jealous of Bumstead occasionally, when he has come round with a pocket full of letters from you, to flourish under my nose. You must not judge me by the length or quality of my letters. I am but a poor correspondent at best; I never had a genius for epistolary correspondence, and when I have the blues, I have to give up entirely; for to inflict my letters on anyone, when I am in that state, would be a little too bad. I wrote two letters to you last week and week before, which I did not send, because after writing them, I thought them rather too prosy.

All day I have been busily engaged in preparing the accounts of the last year, which are now ready to send on to Washington. Our calculation is to start on the survey June 1st. Do you still think that you had better go, that you are equal to the fatigues and exposures of the season? If so, I suppose that you can have a place as assistant sub-agent at $2 per day, or possibly as clerk at $3. . . . I should so much wish to have you with me, that I am afraid to trust my own judgment in regard to the effect of such a trip on your health. . . . The first month will be the severe one. After that the difficulties will rapidly diminish. I will make it as easy for you as I can, and there would be many pleasant things about [it] even in the worst of the difficulties. I do not see that it is possible for Bumstead to go, as there will not be a single vacancy into which he could creep. There are two or three loafers attached to the survey, whom I should be glad to see turned out . . . but the Doctor will not do it.

Write soon—don't wait till you have time to fill a whole sheet, but let us have five cents' worth a little oftener.

Meanwhile, as if it were not task enough for the survey to unravel the geology of "a hundred thousand square miles of unbroken wilderness, tangled thickets, marshes, and lakes," there were, in addition, difficulties at Washington. Congress was slow in passing appropriations, and even after funds had been voted, Jackson could get his money only by "sticking to the treasury door." Moreover, the Michigan congressmen felt that no outsider could do justice to the mineral resources of their state; and only the utmost efforts of the head of the survey defeated an amendment to the appropriation bill, which would compel him to reside in the state, have all the chemical work done at Detroit, and employ as assistants only "practical" men acquainted with woodcraft and citizens of Michigan. There was, besides, much hostile criticism of the survey, much ventilating of the incompetence of the assistants, and much personal opposition to Jackson, on the part of mine owners and men actually on the ground, some of it at least from men whose opinion was entitled to weight. Jackson himself, at this time, seems to have been by no means at his best. His long controversy with Warren and Morton and Wells over the discovery of anesthesia had consumed his strength and preyed on his mind. He talked of nothing but ether, and his letters to Whitney on this topic display a bitterness foreign to his nature. Altogether it is easy to believe that Jackson was a sick man in 1847 and 1848, stricken with a touch of the malady which, years later, sent him to end his days in an insane hospital.

Be this as it may, disapproval of the conduct of the survey became so outspoken, that in the spring of 1849, Foster and Whitney both resigned; there was an investigation by the department at Washington, with the result that Dr. Jackson was allowed to retire, while the completion of the survey was given over to the two assistants.

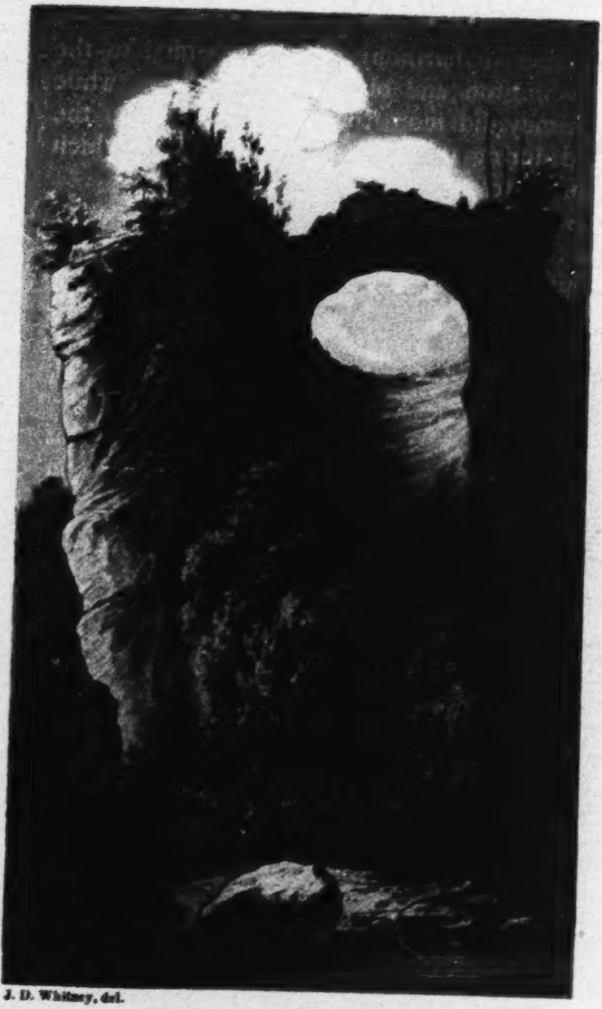
This promotion, for it really amounted to making Foster and Whitney each an independent head of a survey of his own district, involved rather an increase of responsibility than a change of work. The two young men worked together in harmony; Foster attended to the Washington end of their joint affairs, while Whitney did more than half the work in the field during the two additional seasons which sufficed to complete the survey.

Several new men joined Whitney's party for the final summer, among them Colonel Charles Whittlesey of the United States Army, who had been topographer and geologist on the Ohio Survey; Édouard Desor, who had worked with Agassiz on the Swiss glaciers; and James Hall, at that time the head of the New York Survey, and still commonly accounted to be the first of American paleontologists. Their work for the field season of 1850 was in the eastern end of the Peninsula, especially along its southern border.

TO WILLIAM DWIGHT WHITNEY

CLEVELAND, *June* 24, 1850.

. . . We arrived — that is to say the geological corps, consisting of Mr. Desor and myself — yesterday afternoon in good health and spirits. Col. Whittlesey we soon found, and he professes a willingness to join our corps for a short time,— at least until he shall have received definite information with regard to the boundary line between Minnesota and Iowa — which he expects to have to run. Of course



J. D. Whitney, del.

ARCHED ROCK, LAKE SUPERIOR

he and Mr. Desor are already buried in the [glacial] drift up to their chins and will be till the boat leaves.

. . . Two of us will probably go to the Sault, and two stop at Mackinaw; that is to say, if Mr. Hall joins us to-day, as I expect. . . .

We shall thus have two parties of two each, and I think it may safely be said that they will be tolerably strong parties. I do not think we need be ashamed of ourselves when we have such men as Hall, Desor, and Whittlesey with us.

It seems queer to be directing the movements of a corps, all of whom are older and more experienced than myself! At least I need not feel ashamed of my company, as I did when Jackson sent me on with the "rag, tag, and bobtail" of his party, to get them out of his way, the first year we came up.

TO WILLIAM DWIGHT WHITNEY

North Shore of DRUMMOND'S ISLAND, *July* 15, 1850.

MY DEAR WILL, — Mousing round in the bushes just now, I came upon [two of the men] frying an enormous pile of doughnuts, by way of making time pass off with speed. The association, you can conceive, led me naturally to think of writing to you, and of thus making use of a spare half-hour before dinner, which might perhaps, otherwise, be less usefully employed. . . . The wind is strong ahead, and we are dégradés on a pebbly beach on the north shore of Drummond's Island [near the upper end of Lake Huron], which we are circumnavigating (Mr. Hall and myself). We are making a tour among the islands of the St. Mary's, collecting fossiliferouses, and catching trout.

Let me see, I think that I have not written since we went to the Sault. . . . We waited two or three rainy, easterly-weather days at Mackinaw, where I tried in vain to fit out Whittlesey and Desor for the west. Then we all went to the Sault together. We found some difficulty in persuading the men to go [up the Lake], as it was late and they no longer expected us, and they had, therefore, made preparations for fishing. But finally, by the promise of a few additional dollars, to make up for the cost of the nets, we secured [six men]. . . . We all started in two boats and went together over to St. Martin's Islands, where we camped for the night; and the next morning we separated, Whittlesey and Desor to go west and examine the coast and ascend the Manistique River, while we are to circumnavigate in this region for a week longer, and then make all sail for the west, and overtake the other party at Bay de Noquet.

We have collected splendid fossils, which are abundant beyond anything I ever saw in this region. Mr. Hall is in tall clover. I must tell you about our Saturday night's encampment. We had been sailing along until it began to grow late and saw no signs of a spot suitable for camping, or a place where we could haul out our boat, and we had thus far not seen a rock in place on the Island [i. e. they were in the glacial drift]. Suddenly we descried a flat surface of rock descending gradually into the water. As we approached, I let fly [a] gun and killed eight ducks at a shot. We then ran our boat upon the rocks, which we found to be filled with beautiful fossils. We stepped ashore and found ourselves on a level, open surface of rock, without much soil upon it, but covered with the greatest profusion of strawberries! . . . The next morning, after breakfasting on our ducks and the trout, which we had caught the day before, we started out in search of fossils, which we found in the greatest beauty and perfection, and which we literally picked up from the midst of the beds of strawberries. We collected some 200 lbs. of fine corals, etc. in a couple of hours, besides stopping occasionally to refresh ourselves with the ripe strawberries. . . .

Mr. Hall and I get on very well together. I shall learn a good deal of him in the way of Paleontology, a branch which I never expect to be a proficient in, in these days of specialties, but which one can hardly help learning something of, in voyaging in a fossiliferous country with a man who is so skilled in his specialty as is Mr. Hall.

You must not be surprised not to hear from me again for a month or six weeks, as it may be difficult to get our letters forwarded.

This summer's campaign completed the field work of the Lake Superior Survey. Not for five years did Whitney undertake another task of like sort.

CHAPTER V

THE METALLIC WEALTH OF THE UNITED STATES. 1850–1854

IT was now William Whitney's turn to go abroad. Of the five years since he graduated from college, he had spent four behind the counter of his father's bank, while the leaven of Bopp's Grammar worked in his mind, and he saved twelve hundred dollars toward his emancipation from business. After his summer on the Lake Superior Survey, he entered Yale as a graduate student of Sanscrit; and in the fall of 1850 went to Berlin to become a pupil of Weber, and later to Tübingen, where with Roth he commenced editing the "Atharva-Veda."

Josiah, in the meanwhile, had set up a private laboratory in Brookline, and was engaged on the analyses of the survey just completed, on its final reports, and on various special papers for scientific journals. Of these, he had already brought out seven, all except one on chemical subjects, and together of sufficient merit to win for him, in August of 1850, his first scientific distinction, membership in the American Academy of Arts and Sciences. Now follow in rapid succession six more special papers, four of them on geological topics. From this time on, Whitney is no longer predominantly a chemist.

TO WILLIAM DWIGHT WHITNEY, AT BERLIN

BOSTON, *November* 11, 1850.

. . . Luck seems to have favored you highly and nothing can be more satisfactory than the good account which you give of yourself thus far. I shall depend on hearing all the particulars of your course of study in which I, too, shall feel a strong interest, for did I not steal from dear old Bopp and Grimm many a lecture, going away always with a longing desire to turn up double, some day, and set one half at work on philology. . . . As for myself everything is going on as usual. I have written our synopsis and forwarded it to the Department; and have, also, with the help of Desor, written an article of some length giving the general results of our explorations. This we have sent to the Geological Society of Paris. I mean, as soon as I can find time, to get up an article on the nature of the copper deposits of Lake Superior, for "Poggendorff's Annalen." My laboratory work is going on, and I shall probably have enough work to do there to occupy me a couple of months busily.

. . . We tried to elect Foster into the

[American] Academy last Wednesday, but met with a Waterloo defeat. Jackson was there with all the forces he could muster, and voted, but said not a word. I think that the unpopularity of Bowen and Cambridge in general helped a good deal, though, doubtless, Jackson influenced several votes. The wonder is to me how he could not manage to keep me out.

TO WILLIAM DWIGHT WHITNEY

BOSTON, *April* 1, 1851.

I spent ten days of the first half of March at Albany, where I went as a witness in the cases of Agassiz and Hall. . . . The suits were for libel, and brought separately against Agassiz and Hall, by a man by the name of J. T. [not J. W.] Foster, the author of a ridiculous attempt at a geological chart, damages in each case laid at $40,000! The chart was a most absurd production, the work of a complete ignoramus, and yet was recommended by that miserable old sneak [the name omitted is that of a well-known geologist], who had been offered a pecuniary interest in it. With ——'s recommendation, there was a probability that it might be adopted in the schools of New York. To prevent this, Hall wrote to Agassiz, requesting his opinion of the production, and having got an opinion expressed in strong language, published it and killed the chart dead. On this, suits were instituted against both. —— was the only scientific, or would-be scientific man who could be found willing to endorse the chart. [James Dwight] Dana, [J. W.] Foster, and I were there to testify as to its merits. We were each kept on the stand a day (three days occupied in our direct and cross-examinations), and you may imagine that the chart was pretty essentially hauled over the coals. We did not spare; and the more they cross-questioned us, the more the truth would come out. The Judge took the highest ground possible in favor of the right to criticise, and the jury required an absence of only a few minutes to make up their verdict for Agassiz. Hall's case was dismissed by the Judge with the consent of the plaintiffs, as they saw they had no hope, and we returned home in great glee. I had a good opportunity to get well acquainted with Agassiz and Dana, as we were together all the time for twelve days. Agassiz is a very fascinating man, and it is impossible not to like him, even in acknowledging that he, like all the rest of mankind, has his faults (except you and me). Dana is a "brick and no mistake."

It is no small task to get out a geological report. There is, to begin with, a great mass of field notes to be put into shape for printing, or plotted on maps and sections. There are observations to be reduced, minerals to be analyzed, fossils to be described and pictured, maps to be drawn and engraved, illustrations to be lithographed, of a sort to catch the eye of the legislator and make straight the path of appropriation bills. Appropriation bills, too, have to be watched, that paper and bindings may not suffer from a spasm of economy. All this successfully out of the way, printer and engraver and binder must be overseen, to make sure that the government is not cheated beyond custom. In the meanwhile, the chief geologist must edit or rewrite the reports of his subordinates, and in addition prepare his own text, a hundred or two large printed pages bristling with facts.

The Lake Superior report was Whitney's first, and he took pains with it. "The illustrations," he wrote his brother, "are the best things of the kind which have been got up in this country as yet. There will be twenty plates of scenery [his own drawings], ten of fossils, besides maps, sections, and wood-cuts." There were two volumes, one on the copper district, the other on the iron. Desor did the chapters on the glacial drift; Hall the fossils. Whitney himself wrote most of the general geology, though Foster was equally responsible for the opinions. Between them, they reversed some of Jackson's important conclusions; and advanced several new ones of their own, among them the opinion, radical but quite correct, that the so-called "new world" is really the older of the two. Oddly enough, in spite of Desor's connection with Agassiz, the report rather opposed than supported the true theory of the drift which Agassiz had been advocating for some ten years. Strangely, too, since Whitney had been in a way a pupil of Lyell, the more speculative portions of the report have not a little to say of electric earth currents, primeval oceans of hot water, metallic vapors, vast earthquake waves, and the like weird machinery of pre-Lyellian geology. Geology in the fifties was still more than half cosmology.

The manuscript for the second volume of this report was ready for the printer in the spring of 1851; and in the following summer, Whitney indulged himself in a trip abroad and a visit to his brother. It was a pleasure trip — London and a meeting of the British Association; Paris; the Rhine; Switzerland, where once again fate threw him into the company of his friend Wolcott Gibbs.

The letters between the two brothers begin again with Josiah's return to America.

TO WILLIAM DWIGHT WHITNEY

BROOKLINE, *October* 21, 1851.

I think that the real reason why the Dom of Milan made such an impression on you, was that it was so entirely unexpected. It is a glorious work but not to be compared with the Kölner Dom. That, of all the material works of the human mind, has made the deepest and most ineffaceable impression on me. I have seen it at four different visits to Köln and studied it thoroughly. It is the grand realization of a sublime idea carried out in full and entire harmony with itself — it is a whole, a unity. It is in architecture, what one of Beethoven's symphonies is in music, and the two, though so different, have yet the same effect on me. I was delighted that it should have made on you so strong an impression. The cathedral at Milan is more dazzling at first sight, more *éblouissant*, more gorgeous; but it lacks the divine harmony, the *oneness* which makes that of Cologne the masterpiece of art.

. . . My dear Will, some things may have occurred while we were together to mar the pleasure of our journey somewhat, but these I shall forget, and hope that you will, and that you will forgive me if I was occasionally rather impatient and overbearing. I am sure that I shall always remember the short time we spent together with infinite pleasure, and shall look forward to other similar days of enjoyment. . . .

TO WILLIAM DWIGHT WHITNEY

PHILADELPHIA, *November* 4, 1851.

Here we are, settled down as quietly as if we lived here . . . with a good wood fire to toast our shins by, in this cold, rainy, and stupid weather; and calmly waiting the printer's good pleasure to furnish us with proof. We are in the hands of a man who seems, in the opinion of all who know him, to be a great scamp. He has a miserable little concern of an establishment, and having taken the contract lower than he can afford to do it, he expects to make himself good by cheating Uncle Sam in various ways. He has some motives for printing this work well, and, having new type and only a hand press, we cannot come off very badly. . . .

Yesterday and Sunday I spent at Pottsville in the great anthracite coal basin, having run up there Saturday afternoon (92 miles) to see Desor and Rogers [H. D. Rogers, State Geologist of Pennsylvania]. Rogers was excessively polite and attentive, and drove me all around to the most interesting localities in the neighborhood. It is a remarkable region both geologically and economically. Rogers has to finish the field work of the survey next year, and the work is to be published in two quarto volumes in the best style. It will be the most creditable contribution of this country to geological science. . . .

As for Whitney's own report, he did his best to have that printed "in a suitable and decent manner"; but he tried in vain. "The printer," he writes, "seems to have it all his own way, and though he is notoriously defrauding the Government, yet there are so many who have their fingers in the spoils, that nothing seems likely to be accomplished in the way of putting an end to such disgraceful proceedings."

The first edition was so badly done that Congress rejected it; the second was hardly better. There was a small appropriation made for another, condensed, report. But Foster was making money with a marble quarry in Vermont, and Whitney refused to touch the matter at all, until assured that it would be kept clear of jobbery. Long before the spring of 1853, when the report was finally put in circulation, both its authors were heartily disgusted with the whole affair. Meanwhile, a hopeful plan for a private work on the Lake Superior region collapsed promptly, as soon as Whitney learned that a chief promoter of the scheme expected his own mines to be treated discreetly.

The mining industry in the United States was in an unusual condition during the ten years which succeeded 1845. There were some hundreds of unimportant mines, of one kind and another, scattered here and there over the eastern portion of the continent, many of which had been worked since colonial days. The important lead region, which includes some two thousand square miles of the southwestern corner of Wisconsin, and the borders of Iowa and Illinois behind Galena and Dubuque, was developed after 1830. In 1845 came the Lake Superior copper, and in 1849 the beginnings of the rush for gold to California. Oddly enough, the discovery of new mining regions revived interest in the old; and between new and old, as long as the boom lasted, the demand for mining engineers quite outran the supply. Whitney, with his thorough German training, his five years in Upper Michigan, and enough acquaintance with fossils to handle paleontological evidence, found no difficulty in establishing himself as a consulting expert, and soon had a clientage throughout eastern United States and Canada.

It chanced about the time when Josiah Whitney was establishing himself in his new profession, that he made the acquaintance of two "funny boys," friends of his brother William, — Francis Child, later the great Anglo-Saxon scholar, and George Martin Lane, the Latinist, both then, as for the remainder of their working lives, teachers in Harvard College. To the younger Cambridge set of the day belonged also Benjamin Apthorp Gould, the astronomer, who at that time was determining longitudes for the Coast Survey.

"Gould, Lane, and I," Whitney wrote his brother, "have been trying to get a nice, quiet, and retired house in Cambridge, for the purpose of establishing an old Bachelor Hall, to which, by a sort of counting our chickens before they were hatched, we have given the name of 'Clover Den.'"

After no little trouble with landlords who were "afraid of letting a house to such young men," Clover Den finally materialized itself, in April of 1852, in the old Mann house at the elbow of Follen Street, close to the Cambridge green and just off what is now Massachusetts Avenue, but was then "the road to Porter's." The three original "denizens" added to their number another astronomer, Joseph Winlock, who had already begun his work on the "Nautical Almanac," and a man and his wife by the name of Marshall, who between them kept the house. For Whitney, however, during months at a time, Clover Den was but a temporary shelter to which he returned from distant excursions, for the sake of his own books, a place to write, and the two great libraries at his elbow.

TO WILLIAM DWIGHT WHITNEY

ST. LOUIS, MISSOURI, *November* 2, 1852.

MY DEAR WILL, — It is indeed a long time since I have written you, longer by far than I mean to have intervene between my letters; but I have been on the move almost all the time, or else, when brought to a stoppage . . . too feverish and fretting to think of sitting down to write anything more than a hasty page. Since my last, I have traveled many a weary mile, and some very pleasant ones. . . .

When have I met a man this summer to whom I could talk about [the Tyrol, where William has lately been tramping]? Oh, it was Dr. Scherzer, a Viennese gentleman, who is making a great journey through North and South America in company with Dr. Wagner, who has written on the Caucasus. His love for Tyrol is about on a par with mine. . . . If you did not get your enthusiasm worked up to a high pitch on that journey, then it is a pity that you did not have me along with you, for I should have displayed sentiment enough to carry both of us up to a pretty respectable pitch. . . .

As for my own journeyings . . . they have been somewhat circuitous and extensive. I visited all the mines on Lake Superior, went down and through them, and made plans of them all, from the tip end of Keweenaw Point to within hailing distance of Agogebic Lake. [The distance is just about a hundred miles.] My headquarters I made at Mr. [Sam W.] Hill's at Copper Falls, where I was as comfortable as possible. He accompanied me in a good many of my excursions; and if he did not go with me, Stevens generally did, so that I always had company. I forget whether you saw Stevens when you were on the Lake. He is the heaviest owner of mining stocks in that region, and the most active explorer on the Lake. When he first went up, he had 50 cents *in baarem Geld*, and tended saw-mill. . . .

All summer long the woods were everywhere on fire. In the Ontonagon region, their clearings were burnt over again and again; the soil seemed to be nothing but tinder; mining operations were almost suspended to the west of the river, and you could hardly find your way through the woods in the thickness of the smoke. The same was the case on Isle Royale, and we several times saw the light of the burning woods quite distinctly at Copper Falls, a distance of 55 miles in a straight line.

But to return to my voyaging, that you may know how I got here. When I passed through Albany, on my way west, Hall promised to join me during the latter part of the season, and we were to make a reconnaissance of Missouri together. I also desired to have a look at the lead region of Wisconsin and Iowa. . . . Unfortunately my letter to Hall did not hit him, as he was up in Vermont making a tour with Lyell (who has come over to lecture in the Lowell Institute). So I had to set out for Milwaukee . . . without hearing from Hall.

I soon found Lapham [Increase Allen Lapham had become, self-taught, the first authority on all matters pertaining to Wisconsin] who made me stay at his house, and together we oxed [i. e. worked] up the environs of that city during three days of continuous rain. Lapham is a brick, and he treated me in the handsomest manner possible. I had the good luck to be able to purchase at Milwaukee a fine collection of specimens from the lead region (for $10), which had been sent to the State Fair. Lapham accompanied me west; and we traveled together by stage, buggy, and on foot, to Madison, the Blue Mounds, and Mineral Point. [The distance is something like 140 miles through the midst of the lead district of southeastern Wisconsin.] Favored from the time of leaving Milwaukee by the most delightful Indian Summer weather, we had a fine opportunity of seeing the country and its geology. I went alone from Mineral Point to Galena, and thence to Dubuque, spending a week in that neighborhood. By this time our beautiful Indian Summer seemed to have come to a close, for we have had nothing but rain and mud for the last ten days. I have been here since October 30th, busily engaged in picking up fossils at the quarries about the city, calling on the scientific gentlemen . . . and looking for the weather to clear up, so that I may start out and take a look at the Missouri formations.

I shall probably return to the East some time the latter part of this month; it depends on the weather, and on Hall's movements.

The trip continued through Iowa, Missouri, Kentucky, and Ohio; and finally ended at Cambridge at the beginning of December. It was the first of a series of such excursions undertaken during the next two years.

TO WILLIAM DWIGHT WHITNEY

Irving House, New York, *January* 16, 1853.

Dear Will, — . . . What you write about your eyes is very disagreeable news. I had supposed that you were getting entirely over that trouble, as you had not made your appearance at home, and I thought that you would certainly come home for a visit if your optics still continued to trouble you. It seems rather to be regretted, on some accounts, that when you left Tübingen, instead of wandering about in mud and rain and trying to find some reason for disliking that heaven on earth, Tyrol and the Salzkammergut, you did not make a straight wake for the salt water, plunge in and strike out for Cape Cod. You might have taken up your quarters at the Den, and vibrated between there and Northampton. As far as the "Atharva" is concerned, I suppose that can be put off for a few months, without serious inconvenience to anybody; though of course since it has been noised about, through the medium of the "Tribune" and other papers, that you were engaged in the preparation of that work, the reading public is all agog to get hold of it. Why should you not return home at the end of this semester, and spend the summer in bumbling [i. e. loafing] about with me as my assistant, turning your attention again to natural history, and then return in the fall to London and Paris?

You would have lost Lepsius's lectures by coming home, and I am glad that you like him. I always had a strong disposition to admire him, though I have heard him much abused. I shall have a great curiosity to know something of the results which you have obtained from his lectures. Will you not want to make yourself acquainted with what the English Archæologists are doing? I have heard of some interesting discoveries of Layard and Rawlinson, with regard to the antiquity of the book of Daniel, which Lyell said they had found to have been written after the events had taken place which it professed to predict. It seems that Layard was afraid to communicate this discovery to the public, as his publisher assured him that it would injure the sale of his book.

Mr. Hall came to Northampton just before New Year's in a state of considerable excitement, and told me a long story about how —— had stolen a geological map from him . . . putting his name to it as the author, and pocketing three or four hundred dollars by so doing! This is Hall's statement, and I need hardly say that he was "riled up" to the last degree, when he found it out. . . .

There seems to be nothing but quarreling among the scientific men in this country. I certainly have done my share of it, and yet I believe that I have tried to act fairly and honorably toward everyone. There is a triangular contest now going on between Morton, Wells, and Jackson, for the sum of $100,000, which

Congress seems inclined to vote to the discoverer of etherization, if he can be found. Morton has succeeded in having witnesses summoned, and testimony taken, under oath. . . . I had to give mine at Washington. It consisted principally in my having no knowledge of the fact alleged to have taken place in the spring of 1842 in Jackson's laboratory, when I was living in his family. . . . I felt very unwilling to testify; but, after all, it hardly seems right in me to withhold such important testimony merely because I am afraid that my having given it will be ascribed to motives of revenge. What do you think about it?

Materials are gathering in for the large work on the metallic resources of the United States, which I have proposed to Lippincott, Grambo & Co. of Philadelphia to publish. The collecting of the materials will necessarily be a slow job. In the meantime I have numerous offers from parties in New York, to make explorations and examinations, for which I can be well paid, and which will distinctly serve my purpose for the big book. I have every reason to be satisfied with my scientific position, only I fear that I am placed higher than I deserve to be. I cannot begin to do all the work which is offered to me, or rather which I could have, if I should decide to take up my quarters here,

which is one of my plans. I should be sorry to leave the Den, which is so pleasantly fitted up, and on some accounts so desirable a residence; but there are strong reasons why I should do so. Science in Cambridge in my department stands so low, that it is painful to be there: A——! B——! I cannot expect to get much work as long as I remain there. It would be pleasant if you could take my place when you return. . . . Cambridge would be a better place for you than for me.

I am much tempted to make an *Ausflug* to Central America! Dr. Wagner and Dr. Scherzer are going thither in June, and have invited me to keep them company. It would be a great chance to collect some new materials. But—but—there are many things to be taken into consideration.

TO WILLIAM DWIGHT WHITNEY

NORTHAMPTON, *February* 27, 1853.

. . . Some of the influential citizens of Missouri are talking of offering the geological survey of that state to me; but I have taken no steps to apply for it, having somewhat the dread of fever and ague before my eyes. Exploring in Missouri would do excellently—if October lasted all the year, and if there were any roads or bridges or hotels or anything of that kind. I don't think it hardly pays to have "them shakes." I have an offer to go down in Tennessee and to Pennsylvania and in Vermont and North Carolina and Lake Superior on my hands already. So with all that . . . I asked father yesterday, whether he thought I was in danger of starving for want of work: I managed to squeeze out an answer in the negative.

Edward E. Salisbury, for the sake of inducing William Whitney to come to Yale, has offered to divide his professorship, give him the Sanscrit, and retain the Arabic. Josiah is doubtful.

TO WILLIAM DWIGHT WHITNEY

New York, *May* 22, 1853.

Dear Will, — I would much prefer to see you at Cambridge, but who is there who will endow a Professorship of the Oriental languages handsomely for that College? There is so much more liberality of religious opinion at Harvard, that your position would be pleasanter. As you remark, it would be a pleasure to you to assist in editing the Oriental Society journal, at any rate. If being at New Haven would lay any restraint on you, so that you would be unable to publish and write your opinions in the course of your researches, then I would not go there; otherwise I do not see the necessity of saying you cannot go because your opinions are different from theirs. Gibbs, when consulted about taking a professorship there, remarked that he wished the Faculty to take into consideration that he often worked on Sunday, and rarely went to church. I believe he has not been troubled with any application since that from Yale. . . . I could hardly afford to take a professorship there, as I can earn easily twice as much by my present employment. I am offered $500 a month to go up to Lake Superior this summer. . . . I hope you will find it very pleasant at Oxford and only wish that I could be with you there, this summer, in beautiful England. Pity we could n't visit that little Paradise, the Isle of Wight, together.

As for myself, I have been more of a vagrant than ever lately. I have just returned from a six weeks' tour through the Southern States. I took the steamer to Charleston, South Carolina, thence by railroad into the corner of Tennessee, back again to Augusta, and up through South Carolina into North Carolina to the copper and gold mines around Charlotte, Lexington, Greensboro, etc. I returned by way of Raleigh, Richmond, and Washington. At the latter place I met Foster who is on his way to the Southwest, intending to make some explorations away nearly to the base of the Rocky Mountains, for some people in Washington. The precise locality of his destination is a profound secret, I believe.

TO WILLIAM DWIGHT WHITNEY

COPPER FALLS [MICHIGAN], *August* 19 and 22, 1853.

. . . I was much surprised to see by the "Hampshire Gazette" that you had actually returned a fortnight since. The last I heard was that you were coming by a sailing vessel. . . . However, you are safe at home, and I don't believe that you have lost anything by not being a month or six weeks on the way. You will have time to make a long visit [at Northampton] before I shall be at home. . . .

My business has kept me peregrinating in every direction. I have been to Prince's Bay, Isle Royale, and Michipicoten Island [Ontario]. To-morrow I expect to leave with Hill for the Ontonagon. . . . Then I must go to the Portage. . . . The season has been very pleasant for exploring, and there is much of interest to be seen through the country. Only I have been so continually "on the go" for the last thirteen or fourteen months, that I am pretty well tired out and need repose. . . .

I am going out to the lead region as soon as

I get through here. . . . I have business out that way in collecting information for my book, for which the materials are gradually accumulating. Two or three months more will place me in possession of original observations on all the different mining districts of the country this side of the Rocky Mountains, and of nearly all the important mines. [This] winter [I plan] to get together as fast as possible the materials for the work on the metallic wealth of the country. My position now is a very good one, since I can carry out a favorite plan, and make some $500 a month in doing it. I get that sum now and have hardly any expenses here. They are talking of sending me to England this next winter. . . .

We shall be able to talk over our plans together next October, and I hope that I shall be at home during a few of the last fine days of autumn, to join in that "gay time" of which you speak. If you are at a loss for manuscript to copy, and have eschewed the Orientals for a space, I can only say that I can give you a pretty respectable salary to act as my assistant. Will you not write that article for the "North American Review" on the Egupshun Arrowglifficks? I wrote to Bowen about it, and he expressed himself tickled at the idea.

TO WILLIAM DWIGHT WHITNEY

OGDENSBURG, NEW YORK, *November* 6, 1853.

. . . You may be having the most delightful Indian summer down in your latitude, but up in this arctic region we are enjoying the rigors of a Siberian winter. . . . This evening the stars are twinkling with that peculiar vivacity which indicates that the thermometer is down to somewhere about 15°. For all that, it is melancholy to think that I must leave this comfortable room at the dread hour of midnight, and ride till morning, without ever a bottle of hot water to my head, or a fur tippet around my feet. My teeth chatter now in anticipation. And to-morrow I must descend into the bowels of the earth, and indulge in a subterranean shower-bath of fearful duration! How much better to be oxing up what some old fogy of a Pharaoh did, ten thousand years ago, in a comfortable arm-chair by a warm stove! . . . We did not reach Montpelier . . . till midnight, having been detained by a train which had run off the track, and smashed up; and yesterday we leaped our engine over a big log which some malicious devil had placed across the track, but which luckily failed to throw us off. . . . I think I won't get caught up here again in winter unless it is necessary.

With this excursion, the field work of the year came to an end, and Whitney settled down in his winter quarters at Cambridge to write the book which he named "The Metallic Wealth of the United States" to his public, and "Grambo" to his friends.

The memory of Clover Den has not yet faded out of Cambridge. All four of its inhabitants were on the way to distinction; Lane was all his life a famous wit, and between linguists and men of science, the College and Coast Survey, when all roads led to Boston, the Den, entertaining largely, brought together a brilliant company of guests.

To the setting of this fellowship, Whitney contributed "his beautiful books"; and Winlock the fourth largest telescope in the United States, which he mounted in the henhouse, and by a natural association of ideas christened the Shanghai. Winlock with his own hands built a banqueting table at which a handful of the inner circle, togaed in blankets and sandaled, dined in the Roman manner, with the factotum Marshall as chained slave at the door, and all tongues except Latin taboo. The four associates, combining two ancient customs, united in adoring a gracious lady whom they called the *Angebetete*, but whose chief function was to preside over mixed dinners. Altogether, life at

Clover Den was not conspicuously commonplace.

Some touch of its gay spirit survives in Whitney's brief notes to his brother William, who himself spent long weeks at the "Grambo Shop" serving as "Hypogrambographer."

TO WILLIAM DWIGHT WHITNEY

CLOVER DEN, *December* 25, 1853.

. . . A merry Christmas to you this fine morning; to you who have some chance of being merry. To us, alas! that hope is not extant. The "femineo ululatu" in the cellar under my feet, informs me that five have been added to our stock of puppies this morning. And as misfortunes never come single, Z—— has informed us that he intends to tear himself away to-morrow. In this flying visit of a month, we have found in his character much to admire, and we trust that, should circumstances render it convenient for him to come again soon, he will spend a few years with us, so that we may feel less pressed by the fear of his leaving and so enjoy his call somewhat better.

I know that you have a Christian heart, and so I take it for granted that you will hasten down to console and sympathize with your afflicted brother under all these tribulations. As soon as you have wound up 1854, and set it going, I shall expect to see you here. . . . Bring down . . . some doughnuts.

TO WILLIAM DWIGHT WHITNEY

December 27, 1853.

. . . You must positively be here by Wednesday noon at the latest — better Tuesday night. It 's all gammon to say that you won't want to hear Julien more than a couple of times or so. You must be here to the rehearsal on Wednesday afternoon. As for helping in my book, I have got lots of work for you to do, and I shall bore you with it as long as I can persuade you to stay. Nothing but deadly poverty prevents my having a privateer, as Gould calls his small red-headed secretary or grammaticus. You had better bring down some work of your own, so that I shall not seem to be using up all your time. I only want to get enough out of you to pay for your board. As for Z——, it is not that I don't like him very well, and I was, after all, rather sorry to have him go; it is that he has so little delicacy in his manners and ways of doing things. I can't get over his inviting himself to our house to keep Thanksgiving. You see Lane and I are so different about some things. He considers it a good joke to have half-a-dozen strangers in the house to tea, unexpectedly, and nothing under heavens for them to eat, and not knives and forks enough to go round. His principles are not in the slightest degree opposed to sleeping three in a bed.

As for your idea about coaxing something out of mother for the Den, I would remark that it is all fish which comes to our net. Sassengers, when you knows the lady as made 'em, is particularly edifying. Maria might make us some cake, p'r'aps.

Did I write to you about the glorious performance of the Messiah, on Sunday night? No, I believe not. I never heard so fine chorus singing anywhere; such clear enunciation and volume of voice. The solos were taken in a way that nobody need be ashamed of, by resident Bostonians. All I can say is that I hope they will give us Elijah, while you are here. By the way, would n't it be a good plan to bring the score down, on the principle of the boy who had the salt ready for the egg that Providence might send?

Hall writes me that he is coming down to spend a few days. . . . That should be a strong additional reason for you to come as early as possible.

TO WILLIAM DWIGHT WHITNEY

January 3, 1854.

. . . I shall expect you on Thursday and will be at the Fitchburg R.R. depot on the arrival of the train. . . . Bring up with you a mask and a glove for fencing, if you can find them; also Bancroft's History; also Lapham's Map of Wisconsin, if you can lay your hand on that. . . . As for eatables — I am principally anxious lest you should miss, at our homely table, the twenty-five hot buckwheats with which you have been wont to plaster your stomach, every morning. . . . So you must bring down something to nibble at in the between-meal hours. Now is the time to ox up Lunam with the Shanghai.

TO WILLIAM DWIGHT WHITNEY

February 15, 1854.

. . . Things go on at the Den as well as could be expected considering the weather, which is atrocious. Grambo is moving along at a respectable pace. Mr. Parker preached a tremendous sermon on the Nebraska bill, last Sunday. I was sorry that you were not here to hear it. . . . Pais gave a concert, night before last. . . . I could n't go on account of the dilapidated state of my only pair of black pants.

TO WILLIAM DWIGHT WHITNEY

February 26, 1854.

. . . As far as the work on Grambo goes, I think that I shall have 350 foolscap pages of manuscript ready to print, and most of the material collected and arranged. There is nothing new going on. The Pinakothecarius [Lane] has gone to New York; the Glyptothecarius [Winlock] will not be back before April. The Bpothecarius oxes Hydrargyrum [i. e. B. A. Gould studies the planet Mercury] and grumbles at the weather, which is truly abominable. . . .

We had quite a meeting of the solid men of Boston last Thursday afternoon. Rev. Dr. Blagden of the Old South got tremendously hissed for asserting that Slavery was of divine origin. After all the old fogies had said their say, there was a great call for [Anson] Burlingame! the meeting being decidedly more anti-slavery than its originators. The day the Nebraska bill passes, I shall begin to pack up and get ready to move to some infidel, despotic country, where such good democratic Christians as Pierce and Douglas don't grow. Will you come along?

Yours ever,
Jo, Apothecarius, etc.

TO WILLIAM DWIGHT WHITNEY

March 28, 1854.

. . . I am very sorry to learn that Edward [a brother just turning twenty-one and still at home] has undertaken the flute. There are 6,000,000 good reasons, in his case, why he should have stuck to the piano. . . . I could have given him a common, eight-keyed flute, which is of no use to me.

There are only two instruments which a young man (unprofessional) should attempt to learn — piano or violin (unless he wishes to play in an amateur four-letter party). Any man who learns the flute is a jackup. I am a jackup. Don't you be a jackup. Don't let Edward be a jackup.

TO WILLIAM DWIGHT WHITNEY

March 14, 1854.

. . . [I am] suffering with an abominable cold which still hangs on, though somewhat relieved: consequently I am as stupid as a penguin, or as ——.

At New York, I found that it would probably require from six weeks to two months to go to Cuba, and I concluded to give it up. . . . Offers, of the most pressing, were made to me in New York to go to North Carolina, Tennessee, New Mexico, etc. I do not see any appearance of being likely to be out of work immediately. Foster and Hall will both be here this week. I think decidedly best, unless Foster brings up some reasons to the contrary, to push Grambo along as fast as possible. Yet I see that I have got to work like a Trowjun to do it up before June. . . .

. . . As to your going along with me to Philadelphia [to put the book through the press], . . . I see plainly that I have got more material than I can manage; and of course, you know that your aid and oversight would be of great help to me. . . . But it would give me no satisfaction to have you along, if I thought that you would have been employed otherwise and in a better manner. . . . It would be a very stupid job for you, one in which you would have very little satisfaction other than that of doing good. . . . Could you go to Philadelphia and spend a month, ox the Astor Library, and get back in time for [the meeting of the Oriental Society]? . . . But you must take an enlarged view of the thing, and not decide to go merely out of pity for my loneliness and need of help. As to the former, I am used to living alone; and for the latter I could ox up a "privateer" somewhere, I think, who would do on a pinch. . . .

"The Metallic Wealth of the United States" was the first comprehensive work on American ore deposits, and its success was decided. It ran to more than five hundred large pages, contained data from Europe, and in addition to the commoner metals, included platinum, bismuth, antimony, nickel, cobalt, arsenic, magnesium, titanium, molybdenum, uranium, and tungsten. Much of the theoretical part has been, in time, left behind with the progress of science: but its abundance of solid fact kept it for twenty years the standard work of reference in its field. "No one," Whitney wrote his friend G. J. Brush, Professor of Metallurgy at Yale, "knows better than I do, the defects of the 'Metallic Wealth'; and I may add, no one knows better, by actual investigation, how difficult it is to get the kind of information required to make such a work perfect. The American Iron Association spent $6000 to get the statistics of iron in the United States for three years. You can guess from that how much I must have spent both of time and money in getting the materials of my book together. I know by actual count, that I traveled over 20,000 miles in twenty-five different states from first to last."

Hardly was the last sheet of the book off the press, late in June, when Whitney married

Louisa Howe, daughter of Samuel Goddard of Brookline, and cousin to his friend Gould. Mrs. Whitney was three weeks younger than her husband, and thirty-four at the time of their union. The unhappiness of her first marriage, which after fifteen years she had terminated by a divorce, had so far broken her health that for the rest of her days she was never thoroughly well. She was an ardent musician, and shared to the full both Whitney's joy in the art and his technical skill in it; while a certain restlessness and love of change and adventure especially fitted her to be the wife of a working geologist. She had much charm of manner and great social gifts. She was vivacious, friendly, hospitable, interested in people, ambitious for her husband, fanciful almost to excess. Altogether she supplemented to perfection her reserved and sturdy husband.

By way of breaking in a geologist's wife, the pair spent their honeymoon in the employ of a mining company, "oxing up" the north shore of Lake Superior. Here, therefore, ends for Whitney the life at Clover Den.

TO WILLIAM DWIGHT WHITNEY

Sault Ste. Marie, *September* 5, 1854.

Dear Will, — . . . To go back a little and make all things intelligible — on the eighth of

August the Ward took us over to Isle Royale, and thence to Point Porphyry, leaving Louisa in Mr. and Mrs. Hill's friendly care. We [that is, the geologists, not including Mrs. Whitney] had two boats and eight persons in all, so calculated that a party could be left to carry on explorations until the end of the season, should it be found necessary. I also agreed with the Captain to call for us at Rock Harbor [on Isle Royale], in three weeks from the time of leaving. . . . We found the time just sufficient to enable us to do all that was necessary, and we examined the whole coast from Les Petits Écrits, (a little east of St. Ignace), to beyond Pigeon River, and came to the conclusion that there was no reason to suppose there was a workable vein within those limits. The scenery is truly grand in Thunder Bay. We climbed Thunder Cape, 1300 feet to 1400 feet in height, through an extraordinary gorge or cleft in the rock, with vertical walls, smooth and perpendicular for 800 feet in height, and only 10 or 15 feet wide. Down this narrow stairway, we rolled rocks weighing as much as ten tons—certainly the most gigantic rock-rolling fun that ever was attempted; before reaching the half of the descent, the masses became so enveloped in dust and small fragments that nothing could be seen of them, save now and then a volley of fragments shot off, like rockets, when some projecting corner was struck. In Neepigon Bay the scenery is almost as fine. The whole bay is surrounded by ranges of trap bluffs, rising almost vertically from 800 to 1000 feet. On the 24th we took advantage of a favorable day — almost the first and the last we have had — to make the traverse from Pie Island over to Isle Royale.

The next day we were at Scovill's Point, and having a half day to spare, we made a visit, *en masse*, to the Monument Rocks, where we used our axes so effectually for a few hours as to lay it bare on all sides, opening a new and beautiful view from the west. But best of all, Livermore, McGiven, and I mounted to the top. McGiven ran up like a squirrel and fastened a rope around the summit, by the aid of which Liv. and I ignominiously — or gloriously, just as you please — pulled ourselves up. This is a feat which has only once before been performed. We found the height of the lower pinnacle 58 feet, of the other 50 feet, as near as we could measure, with a cord let down from above. Besides, we cut a trail to the Bay, so that anyone could come directly to the rock without trouble. And to cap the climax, we recorded our exploits in full glory of red chalk on a neighboring birch, and I brought away three new sketches.

Punctual to the time, the Ward took us off . . . and touched with us the next morning, at Eagle Harbor, where Louisa got on board. We had a fine run down, arriving at the Sault on the 30th. The next day I left for Echo Lake. . . . This morning the boys started for the Palladean [mine], where they are to explore until I join them, in a few days, whence we all proceed to Spanish River.

The Whitneys spent the next winter in New York, boarding and living in two rooms at 97 Clinton Place, a little west of Fifth Avenue and close by Washington Square.

CHAPTER VI

UNION COLLEGE AND THE STATE SURVEYS.

1855–1860

INTEREST in mining, outside the gold fields, the Lake Superior region, and the lead district which centres about Galena and Dubuque, had pretty well petered out by the middle fifties. There was, in consequence, little demand for Whitney's services in the more settled portions of the country; while to calls into more distant regions he could only answer, "I have married a wife and therefore I cannot come." The "something good" and suitable for a married man for which Whitney waited, turned out to be an appointment, in April of 1855, to the chair of chemistry in the University of Iowa. Inasmuch, however, as the University of Iowa existed in large part only on paper, the chief duties of the professor of chemistry were understood to be in connection with the state geological survey.

The organization of the Iowa Survey was easy-going enough. Hall, also professor in the State University, was supposed to be its head —a position which Hall was glad enough to accept, for the New York Assembly had made him no appropriation for three years, and he had been keeping the breath of life in the New York Survey at his own private expense. But before work in Iowa got under way, affairs in New York took a turn for the better; and almost at the same time, Hall was made paleontologist to the Canada Survey. Among the three, Hall was able to give at most but a quarter of his time to Iowa; so that Whitney, nominally only chemist to the survey, became practically its working head. The two geologists arranged between them that Hall should look out for the general geology and the paleontology, while Whitney should pay special attention to the lead region in the northeastern part of the state, where he had already done privately a considerable amount of work. They agreed besides that, setting off Whitney's time against Hall's experience, the two should work on terms of precise equality and make their report jointly. The Governor, however, James W. Grimes, persisted in regarding Whitney as an analytical chemist hired by Hall.

Added to these causes of friction was the happy-go-lucky character of Iowa finances. An appropriation by the legislature of funds still to be discovered, supplemented by a warrant from the Governor on an empty treasury, was available only as security on which to borrow actual cash at fifteen per cent interest. The assistants loaned to one another; the principals advanced their private means. Whoever was lucky enough to catch the state treasurer with funds on hand, divided with his colleague as his natural generosity prompted, or as the necessities of his subordinates allowed. Under these exasperating conditions, it was only by Whitney's justness and Hall's tact that the two men managed to get through their five years' work together with no very serious clashes of temper or opinion. As it was, the friendship which had begun in the wilds of Lake Superior never advanced beyond the stage which it had reached in 1855.

The lead district, concerning which Whitney had made himself a recognized authority, lies more in Wisconsin than in Iowa or Illinois. Hardly, then, was the field work in Iowa out of the way, when Wisconsin reorganized its geological survey, putting it under three commissioners of whom Hall was chief. Ezra S. Carr and Edward Daniels were the other two members; and the bill, of March, 1857, specified that they were to employ Whitney to complete the survey of the lead district within the state, which Daniels, and after him J. G. Percival, had begun. "The arrangement," wrote Whitney, "seems to me the poorest and most wastefully inefficient one which could be devised." Of the finances of the Wisconsin Survey one gets a hint in the fact that poor Hall, who soon became its single head, never so much as recovered the money which he had advanced for his expenses.

Following close on the completion of the Wisconsin Survey, Amos H. Worthen, who had been an assistant in Iowa but was now state geologist of Illinois, employed his old chief — to whom indeed he owed, in part, his promotion — to report on so much of the lead district as lay within his new territory. In these several ways, Whitney, though nominally employed successively by three different states, in reality made a continuous survey of a single district, and between overlapping of work and delay in getting out reports, really worked for all three states at once. His contracts with the states, moreover, allowed him to undertake a reasonable quantity of outside work, so that in addition to his lectures in the University — a perfunctory labor in the existing condition of the institution — he continued to act from time to time as mining expert. In addition, he devoted some months during the years 1855 and 1856 to the mineral collections of Union College at Schenectady, where his old friend Joy, who had been with him on the New Hampshire and Lake Superior surveys, in Jackson's laboratory and at Clover Den, was now professor of chemistry. Here, besides arranging the specimens which the college already possessed, he negotiated the purchase, through the gift of a patron, of the valuable Wheatly collection. This also he labeled and displayed.

Whitney, therefore, so far from settling down to the quiet life of a university professor, continued the roving existence of the days before his marriage. His headquarters were at Northampton, where he kept his books and did his winter work. During the field season, he flitted back and forth, overseeing his assistants, examining mines, lecturing at the University, and whenever he had a few spare days, stopping over at Union to work at the collections there. At Northampton, during the winters, the Whitneys boarded, sometimes at the family mansion, sometimes at the village hotel, the Mansion House. For habitation, they had also three rooms over a down-town store, one fitted as an office, library, and living-room, another equipped as a chemical laboratory, and the third used as a storeroom. Here, in "the Bookery, the Cookery, and the Rookery," during five years Whitney made his analyses, consulted his authorities, and wrote his reports.

These years, outwardly tame enough, brought a considerable development of Whitney's ideas on theoretical matters, especially on the origin of metalliferous veins. With this went, naturally, a series of scientific papers, printed for the most part in the "American Journal of Science," of which his friend Dana was editor. The time brought also a gratifying increase of professional reputation. Its end saw him, at forty, member of the Philadelphia and Chicago Academies of Science, and of the Société géologique de France.

With honors came also friendships — with Rev. Theodore Parker, "the only man from whom he ever borrowed a book," whom Whitney had long admired and came to know through their common friend Desor; with Rev. Eliphalet Nott, sixty years President of Union College, whom Whitney came to know when Dr. Nott, though already past eighty, had still ten years of work before him. The affection of these two eminent clergymen bears witness to the personal qualities of the young man of science.

TO HIS WIFE

SCHENECTADY, *April 2*, 1856.

DEAREST PEASY, — I got here last night just three minutes before the Tuesday, on which I promised to arrive, had ceased to exist; went to bed and slept like a top: got up this morning at 6¼, breakfasted at 7, smoked a cigar, cleaned up goniometer, unpacked, packed up, got my trunk from express office, all before Joy and Frau came down to breakfast. I soon ascertained that this was to be a great day at the College. The Herr Graf von Peissner (if his name is thus spelt—if not, try Pizener,) was to lead to the altar the fair and accomplished, etc., daughter of our distinguished professor and fellow citizen, Tayler Lewis (don't spell Tayler with an O), etc. So Joy drew himself on in *Schniefel*, etc., all prepared to go to the ceremony, his Frau promising to follow after us, in an hour or so, in festive attire. As for myself, not calculating on any invitation, or any acceptance of any on my part if it came, I had on my Northampton pants, also my coat with ventilating button-holes.

Thus accoutred we went up to the College and found the treasurer, examined the building appropriated to the mineral collections, looked at the outside of about 300 boxes of minerals now stored in the garret, consulted about plans for shelves, etc. Then went into Dr. Nott's house, found the Dr. and Mrs. Nott all ready to go to the wedding. They both received me very cordially. The Dr. insisted on my going with him (he was to perform the ceremony).

He even did me the honor to request the support of my arm to the house of Prof. Lewis. Of course I had to go, and might have been seen, a short time since, in the pantaloons aforesaid and the buttonholes aforesaid, escorting the venerable Doctor up to the house of a man whom I had never seen, to meet a crowd of people I never before heard of.

However, as I had acquired considerable interest in the bride and bridegroom from Dr. Robinson's highly romantic story of their courtship, I was not unwilling to see the fun, half thinking that the "nobleman in disguise" would in the midst of the ceremony, astonish the Schenectadians by throwing off his cloak and revealing his majestic figure covered with diamond-set decorations and grand cordons, announcing his intention of carrying his bride to take possession of the *Stammschloss* of the immortal *Potsdonnerwetter*, to which illustrious family he then and there announced that he belonged. Nothing of the sort, however, occurred. The bride looked very pretty and very pale according to all the rules. She had on — I 'll put a separate note for her costume, if I can find time to write it. Dr. Nott performed the ceremony with much real feeling and admirable simplicity and earnestness of manner.

TO HIS WIFE

MUSCATINE, IOWA, *April* 21, 1856.

DEAREST PEASY, — Our boat left Burlington yesterday forenoon at about 11 o'clock and was until 10 at night getting up to this place. Confound the navigation of the Mississippi! It is the most patience-trying institution I know of. The quantity of freight that was rolled on and off our boat (professing to be exclusively a *passenger* boat) was truly wonderful. . . . The coffee has that same detestable smell which is so intimately associated in my memory with the backwoods of the United States, from North to South. What can it be? You know the famous railroad to Iowa city was opened during the winter. . . . The rails are in some places unfathomably deep in the mud. The locomotive (I cannot say whether it is the only one on the road) looked funny enough splashed with yellow clay from cow-catcher to spark-arrester. The trains are from twelve to twenty-four hours coming through — distance thirty miles or so. It would be better to go in a buggy; but the river is so high, that you can't get at it, to cross it.

I collected a fine lot of coal plants this morning. . . . Some of the stems of Sigillaria (tree-ferns) are the largest I have ever seen.

TO WILLIAM DWIGHT WHITNEY

BOOKERY, *March* 13, 1856.

. . . My occupations this winter have been highly monotonous. From morning to night have I oxed over the analyses of sundry limestones, zinc, iron, and lead ores, etc., for the Iowa Survey. In a few days, all I laid out for this winter's work will be finished. Not a penny of funds has yet come from the West, nor have I received any answers to my letters to Hall asking him for information as to what was to be done. I am inclined to start for Iowa, borrowing some money, if I can get from the Governor an assurance that the money will be forthcoming eventually; that is to say, sometime in the course of the actual geological epoch—the reign of men and monkeys. . . .

TO HIS FATHER

SCHENECTADY, *May*, 1856.

. . . When I went out we had received only $1000 of the $5000 appropriated for the survey. Of the balance, Mr. Hall had a warrant for $1500 which they had been promising to pay ever since last fall; that left $2500, still liable to be drawn. As they did not seem to be likely to pay Hall's draft, and much less any of the other $2500, it seemed to me absolutely necessary that I should go out and make a personal attack on the treasury. Mr. Hall agreed to the propriety of the course; and promised that, as soon as he received the money on the $1500 draft, he would let me have half of it. . . .

I could only raise $500 which I immediately forwarded to you, thinking that with that sum and the $750, which I supposed Hall would hand over, I should be able to pay my debts and that I could raise some money at Burlington for going on with the survey.

. . . To crown all, Mr. Worthen came up from Warsaw to take the field without any money, saying that Mr. Hall had written him that I would supply him with money while we were together. The question then with me was,—shall I let the survey go to the bugs and return home immediately, and leave Mr. Worthen to get his money when he can and be a month before he takes the field, and then only in a crippled way; or shall I advance him the money, and start him out with a suitable team, so that the survey might not come to a dead stop? I decided to do the latter: so I drew on you for $300.

TO WILLIAM DWIGHT WHITNEY

SCHENECTADY, *May* 22, 1856.

. . . The collection here is now all unpacked, and a great lot of rubbish it is. The meanness of the collection furnished by the State Mineralogist is beyond description. Not even quartz is represented by a decent crystal, and there is not a specimen which I would have in my cabinet. The best things in the College cabinet are from the Bristol [Connecticut] mine. There are a few good specimens from Nova Scotia and now and then a decent mineral picked up or given by somebody. At least two thirds are useless. I shall throw away about one third and save another third for the boys to work on. I hope to be through in two or three weeks. . . . I am staying at the Doctor's [Nott] and find it quite pleasant. . . .

MRS. WHITNEY TO WILLIAM DWIGHT WHITNEY

SCHENECTADY, *June 7*, 1856.

. . . I would have come barefoot with scrip and shell and staff to this place to do reverence to Dr. Nott. He is even more benevolent and unselfish than your grandfather, with far, far more talent, breadth of range, and depth of thought. He is an improved St. John — as much love and more brains. You may imagine how my veneration, which I am generally obliged to feed with a Barmecide dinner of abstracts and ideals, flaps her wings and exults. I am perpetually on my knees before this shining reality of worth.

Mrs. Trollope says Schenectady is the only *finished* town in America! It is gone to seed, quaint and asleep, and made up of low broad Dutch houses and trees, under whose heavy foliage grass and toad-stools spring up in the streets. The College grounds are the most charming I have seen in America or anywhere—so characteristic of the place, half Dutch and half rural. . . .

You look down over clumps of low, broad trees, to the Valley of the Mohawk, and beyond, to low, broad ranges of hills. Nature and Art are both in the Dutch style. Great woods, nursery gardens, old shaded parks and pine banks lie behind the buildings, and there is a most extensive college garden in the English style, quite old and kept up at a good deal of expense, with winding walks, shrubberies, shaven slopes, spreading elms, and a wide, clear, tumbling brook rushing about in every direction under any number of little, shaded bridges. The professors live in large, comfortable houses in the College buildings. It is n't necessary here to marry heiresses for a living, since living is too cheap to make it worth while to accept it almost. Mrs. Joy is going to have for a servant the Dutch Lutheran clergyman's sister-in-law! So you see how respectable and economical all the best society here find it convenient to be.

TO HIS SISTER ELIZABETH, NOW MRS. OSGOOD PUTNAM

NORTHAMPTON, *December 17, 1856.*

. . . The Baby weighed eight and a half pounds at birth, and has gone up to ten pounds in the first fortnight. She has very dark and full eyes which shine brilliantly, especially when she is crying for her supper. . . . Whom she looks like nobody knows; but all agree that she is a "beautiful baby." She appears to have her mother's temperament; but is, so far as can be seen, perfectly healthy. . . . The baby's name is Eleanor Goddard, after her Aunt, Mrs. May, whom you remember about. . . .

. . . My movements are rather uncertain. Some people are very anxious that I should go to Mexico, and I may perhaps conclude to go. Louisa feels very bad at the idea of my being away so much (I have just returned from Iowa), but my profession is one that requires that I should be on the go. There is everything to make the expedition to Mexico attractive; barring the separation from Louisa, and the danger which of course one undergoes of being robbed. . . .

Father appears uncommonly well this winter. He comes down to my office every afternoon when I am in town and reads his paper.

. . . When I get fairly to Mexico, and he . . . has you in California, and Will and Maria in Europe, and besides Ed in New York and James in New Haven, not to speak of Sarah down in Connecticut, won't he be busy as a bee in keeping up the correspondence!

TO E. DESOR

NORTHAMPTON, *December* 30, 1856.

MON CHER AMI,— Right glad I was to see your well-known handwriting, yesterday . . . it seemed a long time since I had heard from you. When I wrote you last, I was in Iowa, where I only remained a few weeks; and then returned to Boston, where my wife was staying, and with her went to Union College at Schenectady, N. Y., where I spent a part of the summer arranging the college collection of minerals and fossils, and having a very pleasant time making the acquaintance of the Professors there. Joy, whom you perhaps remember, is there, having married a German wife not long since. After finishing at Schenectady, my wife went back home, and I . . . to Iowa again, where I spent a couple of months only, as the weather was so unfavorable that the field work had to be closed up very early. I never knew such a season at the West before; it was like Lake Superior rather than Iowa.

During the fall, I collected in the Carboniferous beds, principally, and also made some examination in the coal field of Illinois. . . . .

At La Salle the coal measures lie directly on Lower Silurian rocks, which come up there and form an arch two or three miles across. The coal lies directly on Trenton Limestone without any other parting than a seam of fine clay. This we find to be a general fact with regard to the coal of this region. It lies indiscriminately on any group from Lower Silurian up to Mountain Limestone; but, in this wise, that the farther we go north, the greater the hiatus. So we find the coal field of Iowa to be made up of a number of independent basins quite distinct from each other, instead of being in one, as laid down by Dr. Owen. The same is true of Illinois probably. I have collected a good many facts in regard to the mode of occurrence of the lead in the Northwest, confirming the views I have taken in the "Metallic Wealth" as to the character of the veins. When we shall publish a report, I do not know; probably not for a couple of years yet. Our funds have been so limited in amount and hard to get at, that but little has been accomplished. Hall has done nothing for Iowa this last year; he has been sick a good deal. Indeed it is doubtful whether another appropriation is made for our survey. . . . Really, under the present organization I do not much care if the whole thing is dropped.

My thoughts have been turned toward Mexico lately. A party in New York owning a large grant of land on the Pacific coast, is anxious to have it explored. They applied to me last September, but I could not go, . . . so they sent on a large party and wish me to join them as soon as I can. . . . Of course, it would be very pleasant to see Mexico, and very certainly profitable in a scientific point of view; but the question is whether traveling there is not too hazardous to make it worth while for a man with a family to go off. Now if I were a bachelor, like some of my friends, I might rush off to the tropics or the north pole, and nobody would care a copper whether I ever came back or not; but with a wife and baby at home, look you, that makes a grand difference.

You say that "next to a good wife there is nothing like an urchin"—query, urchin, a boy; or urchin [Desor's specialty], a sea creature? My urchin, however, has turned out to be a girl, much to her mother's delight. When Mrs. W. writes you next, she will no doubt fill the sheet with praises of her baby; so I will not say a word. . . .

. . . I meant to have written you about the

Albany meeting [of the American Association for the Advancement of Science, in August] but put it off from day to day until it seemed that any thing on the subject would be old news. There were unusually many geologists present. Almost all, in fact, of any particular note except Dr. Owen. A good deal of interesting matter was brought forward. Emmons had a magnificent collection of new fossils, saurians and the like, — from the so-called "New Red Sandstone" of North Carolina. It was the most curious, striking set of fossils ever got together in this country, as was declared by the paleontologists present. Nobody knew much about them. Rogers made a sensation with his trilobites from near Boston. Dawson, from Canada, makes a very favorable impression on all as a man of great ability: he and Agassiz had a set-to on the subject of the unity of the human race. . . . Lesley gave a description of the Broad Top coal field and pitched into Rogers's theories and facts without mercy. . . .

A great deal of information was brought out on the subject of the geology of the Pacific Coast and Rocky Mountain region from Blake (W. P.), Dr. Parry, who was on the Mexican Boundary Survey, Mr. Schott on the River Gila region, Dr. Newberry on the Pacific Railroad corps. Blake has the task of putting into shape the observations of the Pacific Railroad corps. He also read a review of M——'s geological map, which was followed by some sharp remarks of various persons, not very complimentary to Mr. M——. What an extraordinary production that map of his is! How could it get itself published in so many forms in Europe? Worthen exhibited his collection of fish teeth from the Mountain Limestone at Warsaw; he has hundreds of teeth, like the one you found.

Agassiz treated us to an embryological demonstration of the existence of a personal God. . . . The Association came near voting to print all the sermons preached in Albany during the session. Also the first thing on the programme was to assemble at a church in the city and have religious exercises!! Oh, *Potsdonnerwetter!* How pious we are getting in this nation of filibusters, slave-holders, and speculators (i.e. swindlers). There were some *flare-ups* at the Albany meeting, causing a good deal of excitement and some fun to the outsiders. Hall did not know how to manage in the chair, and by his absurd ruling, put everything into confusion. I am glad to say that the democratic party carried the day against Bache, Henry, and the Cambridge clique in the matter of a revisal of the constitution, which has been so often up for discussion, and as uniformly staved off by the Bache and Co. party. . . .

My brother, the red-headed "good fellow of Will," as you once called him, was married a few months since to the daughter of an ex-governor of Connecticut: and with her and my sister Maria went to Europe in October. . . . I hope you will see them. If you ever see the "Journal of the American Oriental Society" which Will edits in connection with Prof. Salisbury, you will find occasional articles by him. . . . Your work on the echinoderms pleases me greatly; the illustrations are indeed exquisite.

I wish you would tell me more of your personal situation in Neufchâtel—how you live, and all that. Of your political affairs, we hear but little on this side of the water; and I have but a vague idea what is going on among you. . . . How much I should like to talk a while with you! and shall I ever have that pleasure? . . . Mrs. Whitney sends her best love.

Good-bye until next time.

J. D. WHITNEY.

DR. ELIPHALET NOTT TO JOSIAH D. WHITNEY

UNION COLLEGE, *March* 25, 1857.

DEAR SIR,—I have heard in such a way that you have made a visit to Bristol [Connecticut] that I suppose it must be so. If it is, will you give me (confidentially, if you prefer) your frank and explicit opinions as to the existing state and future prospects of the mine.

I have met with such and so many grievous losses myself lately, that I have come to place my chief reliance on Bristol (which hitherto I had not much regarded) for my support. If there is no foundation for this reliance (tho sad to know it), it is best I should know it; and I ask you therefore, if you know, to tell me the simple truth. I had hoped to see you here before this, and still hope to do so. If it is lawful in the law of the Puritans to do so, give my sincere love to your wife and the young immortal committed to her care. May God bless both you and them.

Very truly yours,
E. Nott.

Mrs. Nott is out of town, or she would have corrected this; and added I presume a note of her own. Indeed I would have written more and better myself. But I am sick — and sad — to-day — more so than a wise man and especially a Christian man ought to be.

The following letter to William Whitney was written after Josiah Whitney with his wife had been attending the meeting of the American Association for the Advancement of Science at Montreal.

TO WILLIAM DWIGHT WHITNEY

NORTHAMPTON, *August* 20, 1857.

. . . We were all glad to hear such good news from the baby and his mother. . . . We expect every day to hear that the Governor announces his determination to go to New Haven and see through his own spectacles the young prince. Connecticut Railroad stock has slightly risen, in consequence of the promise of increased travel princeward. . . .

We found Montreal crowded, the hotels poor and jammed. Seventeen ladies slept on the floor of the dining room and parlor . . . the night before we got there. We thought ourselves lucky to get a room about as big as a bandbox. . . . The geological part of the meeting was intensely Canadian; Logan, Hunt, Dawson, and Hall had put their heads together to puff Canada, and snub everything and everybody else. I did not get to the section in time to hear Logan's paper on the Azoic, or I would have replied to it. He did not, so far as I can learn, answer my arguments; but contented himself with his ipse dixit, backed by Hall, who has never seen anything of the rocks in question. They had it all their own way. Hall was savage on Dana, Rogers, and myself, in his address as retiring president. We left partly on account of our miserable accommodations, partly on account of the expense, and more because I was quite unwell, being troubled with a headache which I could not get rid of although I starved myself for three days. Coming back by Lake George we had the most charming weather. Louisa enjoyed it much.

Let me hear of what you are doing in the way of orientalizing. Your L —— is clean daft on the subject of the ark.

TO WILLIAM DWIGHT WHITNEY

NORTHAMPTON, *March* 2, 1859.

. . . I hear that a small appropriation has been made for a survey in Michigan. Joy has been writing for me to the Governor, and I have also written myself and think it not impossible that the place may be offered to me, although not by any means sanguine about it. I lecture a week from Thursday. Subject: "Science, and Humboldt as its Representative Man." Will that do for a title? I have the lecture nearly written and will send it to you to read if you wish, after it is off my hands and delivered.

. . . [F. A.] Genth writes me from Philadelphia that he has discovered a new mineral, which he proposes to call Whitneyite; it is an arsenid of copper, —$Cu_9 As$, — quite interesting; the most singular thing about it is, that I found the same thing at the Minnesota Mine and analyzed it at the mine so far as to make it out to be probably new. But the specimen was lost in some mysterious way, and I have never been able to find it, although I hunted well for it. Fate seems to have destined it to be named after me.

Genth, who had been at Marburg under Bunsen when Whitney was less than twenty miles away at Giessen, was an authority on copper; and "your-humble-servantite" at once took its place among the few score minerals which bear the names of men. It is an uncommon substance. Genth made the determination on a few ounces, and Whitney himself had only "a piece as big as a pin-head to swear by."

TO WILLIAM DWIGHT WHITNEY

March 28, 1859.

. . . The Michigan Survey was given to one of the professors of the Michigan University. They write me that it was a Methodist movement, getting up the survey. Probably the Governor had a vague idea it was a theological survey he was organizing, and not a geological one. Well, I hope the State Geologist will not republish our work without giving us *some* credit, at least.

TO WILLIAM DWIGHT WHITNEY

MINERAL POINT, WISCONSIN, *May* 27, 1859.

. . . I have just come in from a nice trip through the country west of this place, a splendid farming region, rich rolling prairie, with plenty of groves of timber scattered through it; ledges of rock handy, and no stones scattered over the soil — those dornicks which dull the New England husbandman's tools so effectually. At Wingville, I made another bone discovery — a tooth of a Mastodon, taken 55 feet deep, and more to be had by digging, I hope. Yesterday, however, came one of those very severe days which make the geologist's life not so easy a one. The whole forenoon I spent in floundering, wriggling, writhing, creeping and crawling through the mud holes of an extensive and interesting, but intolerably uncomfortable mine, whereof my bones are all aching and my flesh battered. Coming out a mass of wet mud with a human being encased in it, the said human was further inhumanly treated by being obliged to ride 20 miles over a road, which was for all the world like the mine with its top cut off, and a driving northeast storm of rain beating in his face all the way, and washing the mud off from him into his boots. Was n't that comfortable?

On Monday I start for Madison, with the object of making a vigorous attack on the State Treasurer; the results remain to be seen. I would rather have the check of J. D. W. Senior on the Northampton Bank, than a warrant on either the Wisconsin or Iowa treasury.

I hear such lamentable accounts from Louisa of the state of her health, that I take but little pleasure in being out here, and hardly think that I shall remain beyond July 1st; but if she is better, I may come out again in the Autumn.

The "crevices" of the two following letters are the veins of lead ore. Each of these had to be accurately plotted on the detailed "Crevice Map." This was some five feet square, and on a scale of four inches to the mile.

TO WILLIAM DWIGHT WHITNEY

GALENA, ILLINOIS, *October* 9, 1859.

. . . Were it not for the dust, I would say nothing could surpass the last ten days, just cool enough for tramping over the prairies among the crevices; but chilly enough at night, when one huddles dismally over the little stove in the stinking bar-room, by an unsnuffed tallow candle not giving light enough to see to write up one's notes by, and going to bed early just to keep from wearing out one's eyes. The work of laying down these crevices [on the large scale map] goes on slowly: it is a big job and demands more time. To my surprise, I find the people rather interested in the matter, and the papers have kept me and my doings before the public pretty thoroughly. The whole organization of the survey is a peculiarly unfortunate one. . . . If I had said a word to encourage it, there would have been petitions sent in from all over the lead region, this winter, to have the entire survey put in my charge. Hall would not object, but Carr and Daniels would be furious, and it would not be loyal in me to take any step of that kind, under the circumstances.

I have been traveling this last week among the most God-forsaken people I ever came across, in the heart of the mining region, the vilest, dirtiest, most rascally gang a man could well get among. . . . If anything can stand lower than Wisconsin does in point of honesty, I wonder where it is.

[J. P.] Kimball is not with me this fall; as I find it much more useful to hire local assistance, especially the surveyors who can "show me the corners," and locate the diggings on the map. . . .

. . . Through Schenectady I heard to-day that Mr. Dana had gone to Europe. . . . I shall feel quite lost without him; but he has evidently done a wise thing. . . .

My plans are to be at home early in November, and there to remain until the Lead Report is done with. You will hardly see me unless you honor me with your presence Christmas or New Year's; though I don't know as there will be any this year, as mother is only going to keep a small girl this winter and no cook. Never mind, call up at the Mansion (not the family one), and we will feed you and lodge you. . . .

TO WILLIAM DWIGHT WHITNEY

NORTHAMPTON, *December* 22, 1859.

The work I have in hand is so laborious that I shall have to ox diligently to get through all I ought to accomplish, and there are forty other things to be finished up. I stick to the office pretty closely, coming down before breakfast and generally leaving at 10 P. M. Louisa thinks that I am rather too much of an ox, and drags me out to walk, nolens volens. We are blessed with the finest sleighing I ever saw. About a foot of solid snow as prettily distributed and evenly distributed as the letters in the title of my big crevice map, which I look on as a *Künststück*, for a man who can't print, that is to say. . . .

TO WILLIAM DWIGHT WHITNEY

NORTHAMPTON, *January* 24, 1860.

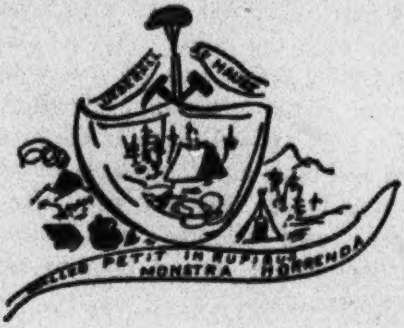
. . . Friday noon, feeling disposed to bumble, and having occasion or excuse therefor in the necessity of getting engravers' estimates on my maps . . . I posted to Boston. I own up to the fact that the desire to see Church's "Heart of the Andes" before it left Boston was a strong element in the propelling power which set me going in that direction. . . .

The picture of Church's was an "astonisher" to me, a sort of new revelation in landscape painting. If it be necessary that a work of art to be great—I mean, *supremely* great—should have unity and produce its effect as a whole, then the "Heart of the Andes" is perhaps not to be placed as high as some other works. But if a landscape *as painted* is to produce the same effect which it does *in nature;* if it is, like nature herself, to bear minute examination and repay close study by an ever new revelation of new beauties, to confound by an inexhaustible wealth of details, to dazzle by a multiplicity of effects, then Church's picture is beyond anything ever yet attempted. You could cut it up into a gallery of landscapes, just as you might the view from Red Hill [near Lake Winnepesaukee, N. H.], only that in one case you would have every kind of view from tropical to Alpine, while in the other, your gallery would be rather monotonously "lake and wood"sy — lacking the glacier, the tropical profusion of animal and vegetable life, the inexpressible majesty of height, an element wanting in our New England scenery. I would give several of my brightest sixpences to see Brown's collection of paintings now exhibiting at New York. I have the highest opinion of his ability. . . .

TO WILLIAM DWIGHT WHITNEY

MINERAL POINT, WISCONSIN, *May* 28, 1860.

You will be moving into your new Palazzo presently, I suppose, and spreading yourself in a locality you may reasonably expect to occupy for some considerable time, while my household gods have to be packed in saddle bags. I think of adopting as my coat of arms, a *tent*, with a



sinister bend in the top (caused by weakness of the ridge-pole); crest, a slice of pork held on a fork, what 's the heraldic slang for that? "Sus, impaled per party gules," I guess is near enough. Motto — " Ueberall zu Hause." Let 's see how it would look. Let me translate the Latin in my own fashion. " He seeks among the rocks for the traces of primeval monsters," which I take it to be as good business as looking around, sword in hand, for that " placid rest in liberty," which we read about, but don't exactly realize.

Whitney is now forty, with a wife and child, but with no settled work and no permanent habitation. In person he is short and strongly built, tough and enduring, and thoroughly inured to the hardness of a geologist's life. Yet with all his rough labor he is fastidious enough when not afield, likes clean sheets on his bed every day, and objects to wiping his hands twice on the same towel. At table, too, though always abstemious, he is something of an epicure. There are certain professions which compel a man to lead a double life in matters of toilet and fare; and those who follow them, when they leave blankets and fried pork, sometimes react violently. In addition Whitney works without respite, goes to bed early and sleeps six hours a night, and has a curious trick — to be justified later by psychologists then unborn — of planning his day's work in bed when he first wakes up.

With his fortieth year, comes to an end the first of the three periods into which his life naturally divides itself. He has been by turn chemist, mining expert, geological surveyor — but never the single head of a survey. From now on, he is to be a geologist, and his own master. He has seen geology change from a chaos of speculation into a coherent science; and geological surveying grow from an avocation of physicians and chemists and amateurs, into a profession for the well-trained expert, of whom he is himself among the first. Now he is to become the forerunner of the United States Geological Survey, whose achievements are to be the nation's worthiest contribution to science.

CHAPTER VII

THE BEGINNINGS OF THE CALIFORNIA SURVEY. 1860 AND 1861

The rush of the Forty-niners to the gold fields of California and Nevada took them into a region rarely visited by civilized men, unmapped, and except for the main outlines of its topography, practically unknown. Dana in 1842 saw something of the country on his way home overland from the bungled and ill-fated Wilkes expedition to the Antarctic; and Frémont's party in 1843 and 1844 had picked up a few fossils, which Hall described. Philip T. Tyson, between 1849 and 1851, explored privately the gold country; and the California Senate printed his report. But Tyson was a chemist, for whom the prospect of extracting wealth from quartz veins seemed "altogether too remote and uncertain to be relied on." Following this, from 1853 to 1856, came a state survey under Trask. Trask, however, though he inspired much of the scientific work of the early days, was by profession a physician, and by avocation more a naturalist than a geologist. His work covered roughly the habitable portion of the state; but his reports were without maps, and no one of the five reaches a hundred pages in length.

The railway surveys, from the middle to the end of the fifties, were accompanied by geologists, Blake and Marcou among the number; while Newberry, as geologist of the Ives expedition up the Colorado, made out, in part, the structure of the region beyond the mountains. Blake, in addition, reported briefly for the Coast Survey on the sea border below San Francisco. All these, however, were but hasty reconnoissances. In 1860, California was, geologically speaking, an unknown land.

The credit of putting an end to this state of affairs belongs in some small measure to her who was born Elizabeth Whitney. It had been her dream, from the time she married and went to California to live, to have her beloved brother at once her neighbor and the head of a state survey.

California in its early days had few inhabitants, and still fewer citizens. Among these few, however, was Elizabeth Whitney's husband, S. Osgood Putnam, who had come out alone in 1850, made his place and established his family, and in the late fifties was the secretary of the California Steam Navigation Company. All but a half-dozen of the American states had by that time established their geological surveys;

and Putnam, glad to further the interests of a state especially dependent upon mining and agriculture, and at the same time to please his wife, gave himself unsparingly to the project of a survey for California. He was himself an influential citizen, and he soon interested others like himself. Among these was Judge Stephen J. Field, whose brother, Rev. Henry M. Field of New York, was a friend of the Whitney family; the Judge, though in general a thorough party man, did his best to keep the survey out of politics. There was also John Conness, then a member of the California legislature and afterwards United States Senator from his state, whose well-deserved monument is a peak in the Sierra Nevada. To these three belongs especially the credit of instituting the California Survey.

There were backing and filling and years of delay, while the Californians waited to see what the general government could be persuaded to do without expense to them. Finally, April 21, 1860, John G. Downey, Governor, approved "An act to create the Office of State Geologist, and to define the duties thereof."

"J. D. Whitney," read section one, "is hereby appointed State Geologist, whose duty it shall be, with the aid of such assistants as he may appoint, to make an accurate and complete geological survey of the state, and to furnish in his report of the same proper maps and diagrams thereof, with a full and scientific description of its rocks, fossils, soils, and minerals, and of its botanical and zoölogical productions, together with specimens of the same, which specimens shall be properly labeled and arranged, and deposited in such place as shall be hereafter provided for that purpose by the legislature."

Later sections of the bill provided that the State Geologist should report progress "as near as may be at the beginning of each session of the legislature"; and that there should be an elaborate final report on the completion of the survey. All such reports were to be copyrighted and sold for the benefit of the school fund. The stipend of the State Geologist was fixed at six thousand dollars a year, to be paid monthly out of the appropriation for the survey.

The act was a model of its kind. It looked to a thorough survey, broadly planned and extending over many years; and Whitney himself drafted the bill. Its single weakness, certainly not Whitney's fault, was that it carried no appropriation beyond the $20,000 assigned for the first year. For the future, it left the survey at the mercy of each succeeding legislature.

The selection of a state geologist, too, was well managed. The promoters of the survey got a resolution through the legislature that no candidate should be considered at all unless he had first the indorsement of the Smithsonian Institution. Thus at a single stroke, they cut off at least nine tenths of the aspirants to the position.

Trask had a natural claim to be considered. Blake was a candidate, and Whitney's most formidable competitor. But the scientific East, almost to a man, united on Whitney, Joseph Henry alone of the Smithsonian officials reserving the right to indorse Hall also, should he apply. Agassiz urged Whitney's appointment; among his supporters were Foster, Joy, Gibbs, and Gould, the two Sillimans, Eliphalet Nott, Horsford, Lovering, Benjamin Peirce, and Edward Hitchcock, Dana, Brush, and Marsh, Leidy, Conrad, Meek, Bache, Newberry; while the members of the American Association, from their meeting in the summer of 1860, sent a joint letter to the Governor of California expressing their "profound gratification" at Whitney's promotion. The general opinion at Cambridge, New Haven, and Washington was summed up in Agassiz's letter to the Governor.

"A geological Survey of California, to be what it should be in a scientific and practical point of view, requires on the part of the person who shall conduct it, abilities of a peculiar kind. . . . You need at the head of your survey a geologist, eminent for his knowledge in metallurgy, far more than one who might be distinguished in theoretical Geology.

"Considering the particular qualifications for a successful survey of your State, I have no hesitation in saying that there is only one man in the United States fully qualified for it, Mr. J. D. Whitney. . . .

"I do not mean to be understood as if I considered Mr. Whitney as the first Geologist of the United States, taking Geology in the usual acceptation of the word when it is made to include all theoretical questions connected with the structure of the earth, as well as the organic remains contained in the Strata forming the crust. But I know that in those particular branches of Geology a knowledge of which is particularly required for a successful survey of your State, he has not only no superior, but not even an equal, in these United States."

The only real opposition came from Blake, from Lieber, then at the head of the South Carolina Survey, and from C. T. Jackson, who had never forgiven his separation from the Lake Superior Survey; and this Whitney promptly countered by proof of the several motives of the three men. Still the fact remained that this was "the only appointment ever made in California on any other than political grounds." "There is no use," wrote Joy, "of mounting upon the high horse of science, and attempting to ride down the Governor. . . . The object of the survey may be to promote land speculations, and the Governor may have an eye to some gold vein"; and a still less hopeful adviser warned, "Keep your honesty out of sight, or you are a gone coon."

With high hopes, therefore, but with no illusions, Whitney accepted his opportunity.

The new-made State Geologist went promptly to work to prepare for his new duties. He cleaned up the field work in the lead region, or put it into such shape that it could be completed by his assistants. William Whitney undertook to see the reports through the press. His business affairs Josiah turned over to his father. For his library, now approaching $10,000 in value, he built a "shanty" on his father's lot behind the family mansion. It was a story-and-a-half, fireproof structure, with storerooms for furniture above, and a single large room below, which served as study and work-room for Whitney when at Northampton, and for other men of science who from time to time consulted his books. Besides these obligations to the past, there were something like two thousand dollars' worth of instruments of one sort and another to be purchased and shipped, and two years' supply of clothes, especially for the "women-folks"; for in San Francisco everything was at least double price and "you really could n't get a bonnet you could wear for less than twenty dollars."

Most important of all was the selection of assistants. These must needs be unmarried men, for the survey could afford to pay them only twelve or fifteen hundred a year, a sum on which no family man could live in California. They needed to be young men, hardy and adventurous; and companionable men and loyal men withal, if they were to get on together in the wilderness. Many, therefore, were the letters and the conferences with the older men over the latent qualities of this, that, and the other beginner. For Whitney, if he did not need, at least followed the advice which Hall gave him at this time: "If you get good men, your work will go well, and you will be greatly relieved. I remember that Ramsay of the Canadian Survey said,—and had I learned it sooner, I should have saved myself much trouble,—'We have no difficulty in our survey, but we have none but gentlemen on the work.'"

There were eight in the company which on

October 18, 1860, left Northampton for California by way of New York and Aspinwall. There were Mrs. Whitney and a maid; little Eleanor, now a child of four; a general utility man from Northampton, by name Michael Eagan, who could turn his hand to anything from camp cooking to laboratory chores; and of the scientific staff of the survey, William H. Brewer and William Ashburner. There was besides a college boy, Chester Averill, whose family was punishing him for a student prank by sending him on a trip around the world. He knew a little engineering, was a friend of Ashburner, joined the survey for the adventure, acted as clerk, mule-driver, barometrical observer, and general factotum, and turned out in the end to be an efficient and useful man. Ashburner was the assistant in geology, a connection of the Field family, and a former student at the Paris School of Mines. Brewer, now Professor Emeritus at Yale, was then eight years out of the Sheffield Scientific School, where he had been a classmate of Whitney's friend Brush. He had been a pupil of Liebig and Bunsen, was a chemist and botanist, and something of a geologist besides. He had long been interested in the exploration of the far West. In fact he applied for a place on Gunnison's expedition of 1853 and 1854, and was

GEOLOGICAL GROUP

WILLIAM M. GABB J. D. WHITNEY CLARENCE KING
CHESTER AVERILL WILLIAM ASHBURNER C. F. HOFFMANN WILLIAM H. BREWER

refused — not in the end to his disadvantage, since the entire party was murdered by the Indians. Whitney did not know him personally, but took him for the agricultural end of the survey, on the recommendation of Brush, in whose judgment of men he placed the highest confidence. The outcome was most fortunate. Brewer became not only the right-hand man of the survey, but his chief's close friend. Under the peculiar conditions of California, his loyalty and his tact proved hardly less valuable than his scientific attainments.

The party were nearly a month on the way, and, after an interesting though trying voyage, reached San Francisco on November 14. Putnam met them on the wharf; and soon the Whitneys were making the acquaintance of their two young nieces, while the other members of the party were establishing themselves in the quarters which Putnam's forethought had provided for them. Altogether Whitney had good reason to be pleased with his reception. The survey was popular; the Governor friendly. The newspapers were complimentary, and chronicled every movement of the surveyors. Prominent citizens called, to make the acquaintance of the staff. There were, Whitney affirmed, ten thousand applications for places.

Trask, the former State Geologist, acted in the most generous manner, aided his successor by every means in his power, turned over all his private notes, and loaned his collection of fossils. Blake, however, proved distinctly less friendly.

The first thing to be done, after the survey had settled itself in its offices at 67 Montgomery Block, was to try out its camp equipment, and to get some idea of the lay of the land, that detailed plans might be made for work in the spring. It was too late in the season for field work in the central and northern portions of the state, and the Governor, who was a Los Angeles man, advised beginning in the region behind San Bernardino, whence had just come reports of tin deposits of fabulous wealth.

Here, however, the State Geologist shall take up the story for himself.

TO WILLIAM DWIGHT WHITNEY, AT YALE

SAN FRANCISCO, *December* 4, 1860.

MY DEAR WILL,— . . . Soon after my arrival, I went to Sacramento and bagged (literally) $10,000, to commence work on. The Governor was very civil; I was called on by all the dignitaries, and much interest was manifested in the work. Returned to San Francisco and fitted out my party. . . . These left with all the outfit for camp life, a fortnight ago, for Los

Angeles to begin work in the Bernardino and Temescal ranges. I started immediately for the Mariposa Estate with Col. Frémont, to meet M. Claudet, agent of Rothschild's, and M. Laur, sent out by the French government to inspect and report on California. We spent four days together in examining the principal veins on the estate, which are indeed magnificent. We had a very jolly time; and I returned on Tuesday in a great hurry to take the boat for Los Angeles. . . . I plunge into the mountains, and return here again in February to go to Sacramento, to lobby for a new appropriation and then up north into the mountains again.

TO WILLIAM DWIGHT WHITNEY

Los Angeles, *December* 25, 1860.

. . . We came in from the mountains last night after ten days of camp life, having made a little trip west to see how we worked together, what we needed for an outfit more than we had, and what the hitches were likely to be.

Our party as organized consists of myself (known to you personally), Mr. Brewer, Mr. Ashburner, a Mr. Averill, Michael Eagan, cook, Peter Gabriel, mule-driver, and a young Spaniard or Californian, named Gurrado, a brother-in-law of the Governor, as the go-between for us and the Spaniards, . . . who form a large part of the population of Southern California. . . . A knowledge of the Spanish language is almost a necessity now, and I am rubbing mine up as fast as I can. . . .

We have a medium-sized waggon, on thorough braces, drawn by four mules, and five saddle mules in addition. Of course, all the rigging is Californian, closely resembling the Mexican — saddles with big wooden stirrups, high pommels, and straight cantles. Each man carries a revolver and a big knife, and, besides, we have two Sharp's carbines and two double barreled fowling pieces, so that we could do considerable shooting in case of necessity. We never go out from camp, or in town in the evening, without looking to our arms. . . . Every one says it is necessary to be well armed; and that if you are well armed, you will probably be let alone. Our mule-driver was once attacked close by this place, by two robbers; but fought them off, wounding one and frightening away the other. He is a young fellow of genuine pluck, and a valuable acquisition. It is a real *science* to look after mules and their rigging.

In camp we live on game, which is abundant, and fresh beef, which is quite cheap in these parts. The greatest annoyance we have had thus far, has been from the weather. . . . It has rained more or less almost every day since we took the field, and sometimes has poured steadily for twenty-four and . . . thirty-six hours without a moment's interruption. All say that nothing like it has been seen since 1849-50. We are now at the hotel, as we arrived too late to camp, on Monday night — luckily enough, or we should have pitched our tents on the other side the river, which is now swollen to a furious, impassable torrent. Here we are well fed and badly lodged; cold and damp, of course, as in all countries with a climate like this, no provision is made for bad weather or winter cold. . . .

I need hardly say that we find the region an interesting one; we are here just on the limits of the cactus region, and the wild fig or prickly pear is very common all over the low hills. Artemisia and sage are the most common shrubby plants on the plains, and aroma and prickles are common to almost all kinds of vegetables here. The lower ranges of mountains are thickly covered with chaparral, so as to be very difficult to climb. The valleys, or cañons . . . are sparsely covered with evergreen, oaks, and sycamores. The spring is just commencing (December showers bring forth January flowers, in this region). The grass is up high enough to be tolerable food for the cattle, which roam in immense herds over the plains . . . and a good many plants are just coming into flower. . . . On a clear day we find ourselves almost surrounded by distant snow-covered peaks and ranges from 6000 to 9000 feet in altitude. The San Bernardino is the highest, and is about eighty miles due east from us. This is a sort of Gordian knot or umbilicus, of the mountains, where all the ranges come together and weave a curious snarl for the geologist to unravel. . . .

Next to earthquakes, probably what shocks the stranger most is the scale of prices in this region. Provisions are not dear, excepting groceries; beef and flour are cheap even; but all kinds of mechanical work, tools, utensils, labor, etc., are all very dear. Double our prices for common things, and quadruple them for what we call "odd jobs," and you would have an idea of what we have to pay. Meals are always $1.00 each in California; but generally good and abundant. . . .

I was very much struck at Mr. [Rev. Thomas Starr] King's church by the intelligent look of the audience. . . . What struck me most at San Francisco (next to the dirt and the fleas) was the restless energy with which people follow the business in which they are engaged; which of course, is to make a living, and as much more as they can. It seemed to me as if there were but few who did not really intend to return "to the states" at some future time, to remain there if they could accumulate enough to live on.

So for all its twenty thousand dollars, the survey was poor. Popular as it was, it depended for its future income upon men who, for the most part, had no permanent stake in the country.

When, after this first glance at his domain, Whitney came to work out his detailed plans for the survey, he realized that the greatness of his opportunity carried with it problems no less great. California is eight hundred miles long, while nine tenths of its hundred and sixty thousand square miles of area is mountain country or desert, without roads in those days, uninhabited, and in large measure unknown. Its boundaries, moreover, except its sea border, are so entirely arbitrary that any complete study of its geological structure must perforce be carried over into the outlying country; while for most practical purposes, western Nevada, and, to a less degree, Oregon, were then parts of California. Thus four states and Lower California were within Whitney's scope. "I have found out," he wrote his father, "that the State of California is a prodigiously large one. Not that I did not know it before; but now I have a realizing sense of it. It is as big as Great Britain, Ireland, Belgium, Hanover, and Bavaria put together! If I had a complete map of the state, a corps twice as large as I now have, and worked as fast (on the geology only) as the English government surveyors do, I should finish in just 150 years. Having our own maps to make, our labor is tripled; and consequently we shall be through in 450 years or thereabouts — that is to say, if we work as minutely as the English geologists do."

Whitney's problem, moreover, took on an added difficulty from his relation to the legislature. If the survey was to go on for ten, fifteen, twenty years, it ought to be planned with far-sighted wisdom. If, on the other hand, the legislature should at any moment change its mind and stop the survey, the work must have been so conducted as to yield immediate and creditable results. Besides this, the bill called for a zoölogical, botanical, and agricultural survey of the state; each of which, like the geographical and topographical surveys, must make worthy contributions to science, and at the same time satisfy the expectations of voters by no means especially enlightened.

To meet these requirements, various and not altogether compatible with one another, the

State Geologist decided to spend the first year or two in a reconnoissance of the entire state, except the high Sierras. He would start with the San Bernardino Mountains where he had first broken ground, and work gradually north up the Coast Ranges and the central valley. The results would be well worth having for their own sakes, for they would settle once for all the main features of California geology. In addition, should the survey continue, this introductory study would provide a basis for more detailed work in later years. The great mountain range on the east could wait a year or two, until the habitable portions of the state were made out.

In the meantime, there was the ever present problem of maps. Whitney was himself among the earliest of geological surveyors to abandon vague general descriptions, and to follow the modern practice of locating every geologic fact and delimiting every formation on an accurate chart. But the only maps of California were the rough sketches of private explorers, and the linear surveys of the General Land Office at Washington. Both together took in only a minute portion of the country, and both alike were hopelessly inaccurate. From any point of view, scientific, commercial, or military, a trustworthy map was a necessity. To this, therefore, the survey applied itself from the beginning.

The field work involved in these several plans fell during the first years largely to Brewer; for Ashburner, unfortunately, proved lacking in physical stamina. Shortly before he came to California, he had made a survey of Newfoundland, privately, for Cyrus Field in connection, more or less remotely, with the first Atlantic cable. From that lean country he came back with the scurvy; and, though he was apparently cured, the privations of camp life brought on his trouble again. Whitney, therefore, detailed him for special work in the mining regions. He, himself, divided his time among the mines, the field party, the work at the office in San Francisco, and the legislature at Sacramento; while such moments as remained over, he spent on special problems, or in excursions to various points in and out of the state.

So much then for the general scheme. Details appear in Whitney's letters from San Francisco to his brother.

TO WILLIAM DWIGHT WHITNEY

San Francisco, *March* 10, 1861.

My dear Will,— . . . How blessed thankful you ought to be that you are comfortably settled down in your own house, instead of being driven from pillar to post, from tent to tavern as we are! . . . Monday, Louisa and I go up to the seat of government, where, on Tuesday, I hold forth to the legislature as follows: 1st. The objects and aims of geology in general; 2nd. Origin and progress of geological surveys; 3rd. Mining and mineral history of the United States; 4th. What may be accomplished for California by a well-conducted geological survey; 5th. How such a survey should be carried on. These are the "heads" of my discourse. And won't it be dry! Next week I shall haunt the capitol, bore and lobby as long as I can stand it; and hope to get away in time to return to the south by the next Sunday's steamer. I shall find my party at Santa Barbara, and mean to work with them for about three weeks, and then leave them to go ahead on their own hooks. . . . [After that] I, with Louisa, Eleanor, and Mary [the maid], plunge into the gold region, making our headquarters at the hospitable house of William Longley (an old friend of Louisa's) at the "Dardanelles diggings," way up in Placer County, right in the midst of the great hydraulic mining operations. Here Louisa means to remain for about a month. I shall operate in her vicinity, and be governed in my movements by the action of the legislature.

TO WILLIAM DWIGHT WHITNEY

SAN FRANCISCO, *June* 19, 1861.

MY DEAR WILL, — Since I wrote you last, I have set up housekeeping, and am surrounded by shavings, paint-pots, mops, brushes, and brooms, and all the paraphernalia and infernalia of putting a dirty house in order. . . .

We commenced housekeeping Saturday, the fifteenth, Mary, Eleanor, and I; and the same day Louisa started for the "Gosh a' Mighty!" or "Yosemite," as it is correctly called. . . . They probably reached there last night, having got to Sonora Sunday night. From there it was fifteen miles by carriage, and thirty-nine and a half by mule or horseback to the great valley. . . .

I hope the trip will improve her health. Mine has been very poor this last month, although mending now. I was taken sick at Stockton, on the twelfth of May, and have been more or less under the weather ever since. I wrote my address for the California College commencement, and delivered it on the sixth of June; and started the next day for Calaveras County, where I spent a few days miserably uncomfortable. . . . The doctor said that . . . it was the malaria of the . . . Mississippi Valley working itself out, as was often the case in

California with those coming from that region.... Now I am much better ... and only lack brains and energy to be all right again. I suppose I have rather overworked myself of late and need some rest — which is hard to get, as it is not in my nature to stop work if I can help it.

TO WILLIAM DWIGHT WHITNEY

San Francisco, *August* 15, 1861.

My dear Will, — ... After Louisa got back from the Yosemite, I went to New Idria, about two hundred miles south in the Monte Diablo range, taking three weeks for the trip.... Last week ... I spent at the New Almaden mine. ... Monday I expect to be off for Washoe for a month. ...

We have on the stocks a large and fine map of the Bay of San Francisco, reaching from the New Almaden mine up to Napa Valley. It covers a space eighty by forty miles, a mere flyspeck on the area of California. This map I hope to be able to put in the engraver's hands this winter or next spring.

TO WILLIAM DWIGHT WHITNEY

San Francisco, *September* 6, 1861.

... The trip [into Nevada] was in every respect pleasant and satisfactory. I took the stage on the overland route to Carson City. At Placerville I was joined by Mr. Ashburner, stopping there a day to look at the geology of the region. . . . We stopped over a day at the Lake [Bigler on Whitney's maps, Tahoe now] to rest and see Lieutenant [J. C.] Ives, who is encamped there determining the point of intersection of the 120th meridian with the 39th parallel, from which the boundary line of California runs due north. . . .

I stayed ten days at Virginia City . . . and reached San Francisco just in time to learn of the success of the Republican ticket in the state election. I had little doubt that [Leland] Stanford would be elected Governor; but there was a very strong feeling . . . and for days previous to the election there was quiet arming and preparing to fight on both sides in case the Secession ticket had been successful. Conness, the defeated Douglas candidate, was one of my strongest friends, and the chief author of the geological survey bill. . . .

Altogether the first year of the California Geological Survey had been a successful one. The work had begun so late in the fall of 1860 that there was $10,000 of the appropriation left over; and this, with the $15,000 more appropriated in 1862, enabled the State Geologist to take on three new men. The zoölogist, Dr. J. G. Cooper, a surgeon in the United States Army, had been naturalist on one of the Pacific Railway surveys, and was already a man of established scientific reputation. Charles F. Hoffmann, the topographer, was a young German and a find of Whitney's own in California. He was a well-trained man, with some experience, and he soon became one of the valuable men of the survey. Only toward the end of the year, however, did Whitney find a paleontologist to his mind in William More Gabb, of Philadelphia, a man of thirty-two, and already a recognized authority on Cretaceous fossils. For Whitney, contrary to the usual practice, insisted that his paleontologist should go into the field, and actually see his material for himself as it lay in the rocks. Gabb began with no experience outside the laboratory; but he, too, became one of the main props of the survey, and saw it through almost to its end. The survey still lacked a chemist. But Whitney was unwilling to set up a complete laboratory, or to get together a library, until he saw how matters were going at Sacramento, and therefore sent east his more important work to be done under direction of Brush.

The plans made at the beginning of the year had been carried through without mishap. The

Chief Geologist had seen with his own eyes some portion at least of forty of the forty-six counties of California. Brewer, at the head of the field party, had traveled twenty-six hundred miles on mule-back, a thousand more on foot, and enough besides, by other means, to bring his entire tour of exploration close to five thousand miles. In general, the survey had covered the southern two thirds of the state, halfway back from the sea to the eastern border.

"There are many points," wrote Whitney to his brother, "on which we need farther light, although some of the most important ones I consider about as good as settled — for instance, the age of the auriferous rocks of the Sierra Nevada, which I have pretty well made out to be Jurassic and not Paleozoic as everybody has assumed. The auriferous detritus is Pliocene, containing many bones of extinct animals. The coal of this coast is Cretaceous, etc. We have probably two hundred new species of fossils . . . and a great many new animals and plants. There appears to be a strong disposition on the part of some of the prominent men here to have me go to London to represent the state at the World's Fair. But I have not favored the idea, lest it might injure the survey, and being more interested in the geology of California than anything else at present."

The winter rains, two weeks late, stopped outdoor work at the middle of November, when the field party had reached the geyser region west of Mt. St. Helena, some sixty-odd miles north of San Francisco. The workers, except the scientific staff, were paid off. Dr. Cooper went south to San Diego to collect during the winter. The other men settled down at the San Francisco offices to work up the materials collected during the summer; while Whitney, in addition, prepared his first report.

CHAPTER VIII

THE SEARCH AFTER A HIGH MOUNTAIN

1862–1864

TO WILLIAM DWIGHT WHITNEY

SAN FRANCISCO, *January* 19, 1862.

MY DEAR WILL,—. . . Since I wrote last, we have had a very hard time of it here in California: the state has been, and still is, swamped, submerged, inundated, deluged, overwhelmed, — anything in the aqueous line that your fancy chooses. Losses in "the dry way" have heretofore been the greatest calamities brought upon our towns and cities; but this application of the humid process beats them all put together. It has rained almost incessantly all over the state ever since we left the field in November. The fall of water in the mountains has been terrific; everywhere, both in mountain and valley, it is one scene of desolation. Sacramento is now in its third submergence, and what the end will be nobody knows, as there is no indication of stopping. All bridges are gone and communication absolutely cut off in all directions. The Overland mail has not arrived for ten days, and the damage to the road on the "grades" is so great that it is said that it will take two months to make it passable again. What we are going to do for mails, I do not know. Some of them may get through in the course of time, but a majority of them will probably never be heard of again. . . .

It is estimated by some that one third of the taxable property of the state has been destroyed. Sacramento is generally considered as having "gone in." The resources of the state will be very seriously crippled for some time to come, and it is no more than reasonable to expect that, amid the absolutely necessary retrenchments, the geological survey will come in for a share. The estimates will all be cut down to a much smaller figure, or possibly the whole thing will be temporarily suspended.

I am at work on my report, but have not decided how full to make it. We have material for quite a "lengthy" document already. I much prefer, however, to cut it as short as possible, so that it may be off my hands before the season for field work begins, and to save expense. . . . We are all well, in spite of wind and weather. It would n't be California not to keep up good spirits. The drowned-out Sacramentans, even, take it coolly and do not add to the aqueous precipitate by any unnecessary tears. Judge Longley's property at the Dardanelles is undoubtedly more or less injured. It is impossible to get to [the] place at present, as the bridges are down and the north fork of the American River rolls a raging flood, over which no one can pass. . . . Osgood's ranch has escaped without serious damage, being pretty well up on the foot-hills. It would have been very hard for him, if his barn and stock had been swept away, as has been the case with almost all the dwellers lower down in the valleys. Money 4% a month, and not to be had at that.

TO HIS FATHER

San Francisco, *March* 24, 1862.

. . . Our legislature appropriated $15,000 last year for the survey; but of this, owing to the emptiness of the state treasury, I have not received a cent. . . . My account is audited for $10,000, . . . and this the Controller promises me in May. . . . The remaining $5000 still due . . . of last year's appropriation . . . will not be paid before next December.

Now, as soon as I get my $10,000, it will all have to be paid out, and I shall soon have to commence borrowing again at two per cent per month . . . or stop the survey. . . . If you can borrow $5000 and lend it to me . . . I cannot see that you would be running the least risk, as you have the credit of a sovereign state behind you, and there is no reason to believe that the state is going to repudiate. . . . If I have to pay you 12% a year for the money, it will save me 12%, as there is no hope of getting the money here for less than 2% a month.

TO HIS FATHER

SAN FRANCISCO, *May* 29, 1862.

Your letter . . . was duly received on the arrival of the steamer . . . and also the draft for $1000 per Wells, Fargo & Co. I was very glad to get the money, but am sorry that you should feel so uneasy about lending it. . . . I hoped that you would put the rate of interest so high that you would look upon it as a good investment, rather than as a favor. . . .

You seem to think that I ought to stop the work of the survey and wait until the money is paid; but this would not do at all. Neither the Governor nor the people would understand such a move. Everybody here is accustomed to borrowing, and they expect me to borrow as a matter of course. The last legislature did try to mend matters a little for me as an exception, by making my appropriation a special one, to be reserved as a "special fund" out of the first money coming in. . . .

Suppose I were to discharge my assistants:

the corps would be broken up, they would seek and find employment elsewhere; and when I wanted to resume work again, it would be almost equivalent to beginning the survey anew. . . . I could not in the whole United States (or Confederate States either) find two men who would answer my purpose as well as Hoffmann and Brewer . . . and as Gabb has only just come out and begun work, I cannot send him back now. . . .

Suppose that my appropriation of $15,000 for next year is cut down to the extent of $1000 by interest paid for money borrowed, and suppose that that sum came out of my pocket, leaving me only $5000 salary, would it not be better to carry on the work until some results had been obtained creditable to myself and the state? But I have no doubt that the amount I have to pay for money advanced will be allowed as part of the necessary expenses of the survey. . . . No one expresses the shadow of a doubt that the appropriation will be paid in time. I can borrow money here of the sharpest money-lenders on the security of a state appropriation. The state is not really in debt to any considerable extent, but the treasury is empty, and so each creditor has to wait his chance to be paid in his regular order. The Governor and Chief Justice are just as badly off as I am, as far as their personal salaries are concerned. I have already talked with the Governor; he does not wish to interfere with the survey in any way nor to hamper my movements. He is quite favorably disposed, and trusts me to do as I think best. I should not dare to suggest to him discontinuance of the work for a year, for fear he would think me "green" in California ways.

So J. D. Whitney, Senior, financed the California Survey, albeit with many misgivings. In the end, the state paid him in full; and was never, at any one time, in debt for more than a single year's appropriation.

With such slender resources, the survey began its second season of exploration. Ashburner went east to finish in Brush's laboratory his special work on gold and silver ores. That done so far as funds allowed, he left the survey and returned to California, to the less taxing work of a mining superintendent. By way of further economy, the zoölogical work of Dr. Cooper was suspended, and the little that could be done without him distributed among Gabb, Brewer, and Whitney. Thus reduced, the survey carried the reconnoissance of the previous year from the region about San Francisco to the northern end of the state.

TO WILLIAM DWIGHT WHITNEY

SAN FRANCISCO, *May* 3, 1862.

MY DEAR WILL, — This is to let you know that our steamer communications are opened again and that we are now going to have a weekly mail, per *Dampschiff*, for the present, instead of an uncertain one through Indians and snows. . . .

Our camp life for the season has commenced. Brewer, Hoffmann, Gabb, Averill, and a volunteer by the name of Rémond, took the field last week and are now inhabitants of a cotton house over the bay in Contra Costa County, near Monte Diablo, where I left them last night — having been with them for the last five or six days. We have been tracing out the Cretaceous formation — which runs by Monte Diablo to the straits of Carquines at Martinez, opposite Benicia. . . .

Our present party bids fair to be a very pleasant one. Brewer is a capital assistant; Hoffmann does as well in his place as anyone could possibly do. He is a German, twenty-four years old, formerly topographer to Lander's wagon-road expedition, with a capital eye for hills and orography in general, and no vices. Gabb is young and rather green and a good deal self-conceited; but he will find the air of California very salutary for such cases as his. He knows Cretaceous and Tertiary fossils well, and that is the sum and substance of his knowings. He has had no experience in the field, and has but little idea of stratigraphical geology. He draws fossils well and has already materials nearly ready and drawings made for ten plates of Cretaceous fossils of the size of Iowa Report plates. Besides, we have as a volunteer, a young Frenchman, named Rémond, with as good a natural gift for finding fossils as anyone I ever saw. If he will remain with us and the survey goes on, he bids fair to make a capital assistant in the field. Averill acts as mule-driver, commissary, barometrical observer, etc. A young German, *namens* Schmidt, is our cook, vice Michael Eagan, retired from the service.

TO WILLIAM DWIGHT WHITNEY

San Francisco, *May* 29, 1862.

My dear Will, — . . . The party in charge of Brewer . . . are now working down the west side of the Monte Diablo range, on the boundary of the San Joachin Valley, hoping to get about 100 miles in the course of the next month, and then to cross over and join me in the Sierra. We have worked out the geology of the vicinity of Monte Diablo pretty thoroughly, and made a topographical map and a geological on a scale of two inches to the mile, embracing the vicinity of the mountain and the coal beds, now quite extensively worked. We have determined the mass of the mountain to be made up of Cretaceous rocks more or less extensively metamorphosed. The coal lies very near the top of the Cretaceous, and is undoubtedly of the same age as that of Vancouver's Island.

We have also learned from Dr. Cooper's collections that the Cretaceous exists at San Diego, and also carries coal. The metamorphic Cretaceous contains as well developed mica slates with garnets and zircons as one might ask to see in a Paleozoic region, besides a variety of other rocks which have a very ancient look. [They had indeed, previously, been mistaken for ancient rocks.]

While we were in camp at Monte Diablo we had a visit from Rev. Mr. King, Mr. and Mrs. [Edward] Tompkins, and Louisa, and Gorham Blake. They all went up the mountain — 3876 feet high. The day was peculiarly fine and the view one of the most extensive in the world, as, owing to the peculiar formation of the state, the range of vision is almost unlimited from north to south. We saw the white snow-covered cone of Lassen's Butte, two hundred miles distant in an air line; and the whole chain of the Sierra Nevada was spread out before us to the east, northeast, and southeast. We estimated that the area over which we could see, embraced not less than 40,000 square miles. . . .

TO WILLIAM DWIGHT WHITNEY

San Francisco, *June 2, 1862.*

My dear Will,— . . . Having a day of rest here while waiting over, in order to deliver a lecture to-night at this place, I brought up this unfinished letter to be mailed in time for the next steamer. . . .

Yesterday, Louisa and I went over to the anniversary exercises of the College at Oakland, Mr. King delivering the address. We took the occasion to examine Dr. [Wesley] Newcomb's superb collection of shells — one of the best in the country, especially in the department of land shells. He has in all between 10,000 and 11,000 species. Tomorrow I shall push on to the Calaveras copper mines, and to Mokelumne Hill and Jackson — an interesting mining region, which I have not yet visited. Brewer and party will be over from the Coast Ranges in about three weeks, and we shall work up the foot-hills of the Sierra to Mt. Shasta, by the end of August, and we hope to go to the Yosemite early in July. As the coal of this coast is Cretaceous, and this formation runs along the base of the Sierra, we hope to find some workable beds . . . on our route. We have carefully worked up the geology and topography of the region about Monte Diablo, as being a sort of key to the geology of the Coast Ranges.

I think it safe to say that our next winter's report will contain a good deal of interesting matter to the scientific world. We shall be able to settle, or throw a good deal of light on: 1st, the age of the auriferous rocks; 2nd, the age of the auriferous detritus; 3rd, the stratigraphy of the Sierra Nevada; 4th, the age of the Coast Ranges and their structure; 5th, the phenomena of metamorphism, etc. Would it be possible to make a greater change geologically than to come from Southern Wisconsin to California! . . .

My views on mineral deposits will receive an *ungeheure Erweiterung*, as it appears to me, from what I am to see and have seen on the Pacific coast. The whole mode of occurrence of the ores is so different here from what it is in Europe, that I am beginning to feel as if it were here that the solution of many of the problems in this line of inquiry were to be obtained. Certainly the ranges near the Pacific, from Mexico northwards, constitute clearly *the* metalliferous region of the world; and yet I am beginning to think that there is no such thing as a "fissure vein" on this coast. Certainly as the Veta Madre and Veta Grande of Mexico are described to me by the most intelligent miners, they clearly are not true veins. The same is the case with the great veins of Washoe, which certainly rival anything in the world in extent and importance. I am unable to bring them into the category of fissure veins. I hope some time or other to be able to combine all my observations on veins and mineral deposits into one *Arbeit;* but first I must see Mexico and Chile, which can easily be done from this coast.

TO PROFESSOR G. J. BRUSH

STOCKTON, *June* 5, 1862.

MY DEAR BRUSH,— . . . As you say, I am having rather a hard time of it financially; but hope to get through with it without collapsing entirely. The state owes me $15,000 now, and besides this, I have got to carry on the survey for from three to six months longer before receiving a cent. . . . I do not think there is any fear that the survey will be formally killed, but am rather disposed to think that the appropriation may be so small that I shall not feel disposed to carry on the work any longer. We can do nothing with a small sum in this great state, and with so many branches of science to cultivate. Money does not go half as far here as at the East, and what would $7500 (half of $15,000) be for a man who had to make a map and complete a natural history survey of the region extending from New York to Florida and back to the summit of the Appalachian chain, supposing no more to be known of its geology and topography than was known fifty years ago — which is just about the position we are in here, except that the country here is ten times as difficult to explore, from heat, want of water, abundance of chaparral, distance of settlements, and absence of roads. I cannot afford the wear and tear of mind and body merely to make a piddling survey with one or two assistants, and the necessity of making economy the predominating thought. That might be very well in Vermont; but it won't pay here. If the next legislature will appropriate not less than $25,000, we will go on. . . .

As to your magnanimous offer to remain in office without salary, I think you have done more than your share of that already. I shall take the liberty of referring to you as the Consulting Metallurgist of the survey, whose distinguished services will be called into requisition, when we have the means of paying for them. . . .

TO PROFESSOR G. J. BRUSH

VIRGINIA CITY, NEVADA TERRITORY, *July 28*, 1862.

MY DEAR BRUSH,—You see by the date of this letter that I am "over the border" again; but, in truth, the interest of California in the Washoe region is the same as if it were within her own dominions, as all the big mines are chiefly owned at San Francisco, and all the business goes through that city and over the Sierra Nevada. The Comstock lode maintains its reputation as one of the wonders of the world. As I sit now writing, I can look out of my window and see the burrow of the Ophir mine, a vast heap of white pulverized quartz, which has been the refuse of the mine, but is now supplying twenty-six mills with material and yielding about $40 a ton. I saw a large heap of ore at the Mexican mine a few minutes since, worth $3000 a ton; and some specimens—would n't they have brought the tears to your mineralogical eyes? Surfaces of a foot square covered over with silver wool—I don't know what else to call it. . . .

The famous Gold Hill mines are in the direct line with the Comstock lode, and only one mile distant, and I have no doubt that it is all one lode. But the Gold Hill yields chiefly the native metals and so rich that a foot of the lode, . . . cannot be bought for less than $10,000. The worst of the Gold Hill is, that it is cut up into such small claims that it cannot be decently worked. Some are only just the width of a shaft. The coal mines reported as having been found here are all humbug — the accounts of the Humboldt mines are very conflicting. . . . If you wish to have an idea of rocks and mountains, you should come here. Such a bewildering succession of ranges I never beheld. It is utterly useless to try to give names to them, they are "too many" for us. Nature has made the mountains, but has forgotten to put in the trees and sparkling water courses which ought to accompany them.

You would get a new wrinkle by seeing some of the big hydraulic mining operations of the California miners. What do you think of a man's using $140 worth of water per day, with an occasional blast of a couple of hundred kegs (not pounds) of gunpowder, just to shake up the ground a little, and then running his materials over three tons of quicksilver in the sluices? You see I am trying to set forth some of the attractions of the country, as if to bother you for not having come out here.

But it is not all fun: the heat is intense, the dust fearful — and I might add that the expense is *some*.

Interruption of a half an hour during which I have secured a fine lot of *Cretaceous* fossils from the *Humboldt Range:* thus gradually we are filling up the blank in the geological map of the United States, and wiping out the Paleozoic, Metamorphic, and Laurentian!

Yours sincerely,
J. D. W.

The party continued to work northward up the Sacramento valley, until early in the autumn it had reached the region of Mt. Shasta and was within a hundred miles of the state line. Here they established several barometric stations, and prepared for the solution of a somewhat difficult problem, the precise height of the loftiest peak of the vicinity.

TO MRS. WHITNEY

CAMP AT BASE OF MT. SHASTA,
Sunday, September 14, 1862.

MY DEAREST PEASY, — We are camped at a place called Strawberry Valley, ten miles south-southwest of Mt. Shasta, which rises in full view before us to the height of a little over 11,100 feet above us, and about 14,500 feet above the sea. As this is the most important fact to be communicated, I will put it first. We left Shasta City a week ago yesterday, leaving

Rémond to observe barometer, and very disconsolate at losing his chance of going up the mountain. The weather was intensely hot [so that] at noon we had to stop and camp. . . . The next day we went on, and were three days going up the valley of the Sacramento River. The valley of the upper Sacramento, to this place, is one of the most romantic I have ever traveled through; it is a cañon all the way, with lofty steep walls on each side covered with the most magnificent forests of oak and pine. The former gradually die out as we go north, and here we have only pines, firs, and cedars of immense size and the greatest variety. At Shasta City we got fine views of Mt. Shasta from all the neighboring hills; but it was not until we came within some twenty or thirty miles of the mountain that it was frequently visible on the road. From some points, when the mass of Shasta filled up the background with the river and its walls in the foreground, the view was as fine as could well be conceived.

The country adjacent to the river is entirely unsettled, except for a few ranches and taverns used as stopping places along the road. . . . We reached this camp on Tuesday night, and pitched our tent on the edge of the pine forest, on a carpet of strawberry vines, looking across

MT. SHASTA (14,380 ft.)

a little meadow to another dark forest of pines, above which towers the mass of the mountain, the lower 4000 feet clothed with pines and firs, the remainder (7000 feet) either snow or bare rock.

On Wednesday we were occupied with our observations, and in getting ready to go up the mountain. It is impossible to tell how many different stories we had heard on our way up, about the mountain, and how little real information we had obtained. We were told by many that nobody had ever been to the summit, and that it was entirely inaccessible; by others, that five hundred persons had been up this summer. Even when near the mountain we could not ascertain definitely where we were to start from.

At Soda Springs we were joined by a person, who desired to make the trip up the mountain in our company, and we engaged him as a sort of guide here — a man whose only qualifications were that he was good-natured and that he had been up the mountain once before (we have not been able to learn of any persons having been up twice).

We left camp at Strawberry Thursday morning, and arrived at the snow line in the afternoon; and after a hasty dinner, turned in to our blankets early, so as to be ready for a start at 3 o'clock the next morning. Mr. Hoffmann, who has been quite sick recently, concluded that he would not try to go to the summit; so he remained in camp to observe the barometers, and Mr. Brewer, Mr. Averill, and I, with our so-called guide and two others who had joined us for the fun of the thing, constituted the party. We were on foot soon after three and commenced the ascent by following up the snow in one of the deep gorges or valleys of the mountain. As we went up, it began to be harder and harder work, and when the sun rose we found that although we had come up a great height, there was still a greater one to be overcome. In front of us, seemingly but a little way off, were the so-called Red Bluffs over which we were to climb, and which was the highest point of our route which we could see; but we seemed to be forever in getting to them. Below an altitude* of 10,000 feet, it went pretty easily, but the last 4000 demanded of me, at least, frequent stoppages to get breath. I felt relieved always after stopping a few minutes; but the sensation of relief lasted only a very short time, and after a few steps more of climbing, I had to stop again to get breath. Thus the higher we got the slower we went; but all of us reached the summit, one after the other, I last but one, and our guide last of all.

On the summit all looked rather tired and some were soon quite sick. . . . I felt dull and heavy, and a little sleepy, but had no headache or pain, although I did not desire to eat much. Some looked almost black, and all had their eyes more or less bloodshot. The blood settled under our finger-nails, and I had the ends of the fingers of the hand with which I supported the barometer all the way up, slightly frost-bitten. . . .

We were at the top of the mountain at just about 12 o'clock. We suspended our two barometers, which Mr. Brewer and I had brought up unbroken, and found that the mercurial column stood at about 17⅛ inches, which would give roughly a height of between 14,000 and 15,000 feet. We shall not have the exact height above the sea-level for some time, but it is about 14,500 feet—and 500 feet higher than the Finster Aar Horn, the highest mountain in Switzerland.

Whitney's final calculation made the height to be 14,442.3. It turns out to be 60 feet less, or 14,380, so that the accuracy of Whitney's determination is noteworthy in view of the disadvantages under which he worked. This was, moreover, the first accurate measurement of a high peak ever made in the United States.

From this time the subject of mountain

heights took on an especial interest for Whitney. Three months later he wrote his brother: —

". . . If there is a set of the 'Zeitschrift für Allgemeine Erdkunde' in the College library, will you be good enough to look at vol. iv (1855), and see on what authority Mt. Hood is put down as 18,360 feet high? I have been looking up the subject lately, and I have come to the conclusion that Mt. Shasta is the highest mountain in the United States and Popocatepetl of North America. The measurements of Mt. Hood giving 18,000 feet and over is all a fiction."

Whoever the authority, he was wrong by some six thousand feet, for the damp climate of the coast brings down the snow line and makes the mountains seem higher than they are. It is a striking commentary on the state of geographical knowledge at the beginning of 1863, that beyond Mt. Hood stands Rainier, higher than Shasta, while within the boundaries of California, not three hundred miles from the office of the survey, is a peak which overtops them both.

Two years of labor over rocks in the field and maps and fossils in the office had sufficed to make out, in a general way, the relations of the stratified rocks of the western ranges of California and of the great central valley. There remained for the task of the next two years the great lava and granite peaks of the Sierra.

In April, therefore, of 1863, while Whitney and Hoffmann remained at San Francisco, Brewer and Gabb explored the southern end of the chain where it begins to drop down into the Mojave desert. They zigzagged back and forth through the passes, moving gradually northward; and when they could no longer cross the range, they kept on along its western flank.

By the first of June they had reached the valley of the Merced, and were ready to begin the attack on the high peaks beyond its upper end. Mrs. Whitney settled down at the Mariposa Big Trees to read a station barometer through three summer months; Whitney, Brewer, and Hoffmann kept on up the valley, explored the region which is now the Yosemite Park, and continuing up the Yosemite, entered the high mountains beyond.

In the following letter to Professor Brush the unnamed peak is the one afterwards called Mt. Lyell. All comparisons of altitude, however, must be taken with some allowance: Mt. Lyell stopped the explorers at the last two hundred feet, while the great knot of mountains which Brewer and Gabb had skirted earlier in the season proved to be higher than it appeared.

TO PROFESSOR G. J. BRUSH

SAN FRANCISCO, *July* 10, 1863.

MY DEAR BRUSH, — . . . I returned only day before yesterday, from a most interesting trip in the High Sierra, between the Yosemite Valley and Mono Lake. We found the mountains stupendous. The highest points of the Sierra, except Mt. Shasta, are there at the headwaters of the Tuolumne and San Joaquin rivers. Two peaks rise above 13,000 feet, and several above 12,000. As we were out of funds, I had to leave Brewer and Hoffmann to ascend the only peak which can possibly be a rival to the one we were all upon, and which we called *Mt. Dana*, believing it to be the highest mountain in the state, except Mt. Shasta. Brewer's subsequent observations, which I have not yet received, will settle the question, as there is only one other which can compete with it.

The view from Mt. Dana is (we reckon) the finest mountain view in the United States. Language can't do justice to its grandeur. Literally, hundreds of peaks, snow-covered, are around you, in every variety of fantastic form and outline. And farther than this, we are in the midst of what was once a great *glacier region*, the valleys all about being most superbly polished and grooved by glaciers, which once existed here on a stupendous scale, having a thickness, in the Tuolumne Valley, of a thousand feet, and having left splendid moraines — medial, lateral, and terminal. The beauty of the polish on the rocks, covering hundreds of square miles of surface, is something which must be seen to be appreciated. So come on and see it, and bring all your brothers (in science). The Yosemite, with its five great waterfalls from 700 to 2500 feet high, is not a small affair; but did not seem so great after we had camped for a week at an elevation of nearly 10,000!

Brewer and Hoffmann are now on their way back from Aurora by the Sonora trail. I join them in a few days at the Big Trees, and back we go again to the crest of the Sierra on the Big Tree route, and so zigzag via Washoe and so forth up to Lassen's Butte, I hope by the end of August.

As you might perhaps suppose that Mt. Dana was named after some other man, I might add that the Dana intended is the eminent V. P. of the N. A. S. Tell him about our glacial discovery.

Messrs. Dana and Lyell expressed themselves as highly gratified over the honor done them; as well they might, for a thirteen-thousand-foot peak is no mean memorial for any man, while of all human monuments few endure like place names.

For the rest of the season, the party kept along the higher parts of the Sierra, and by the end of the good weather reached the eastern flanks of Shasta. Two letters, written at this time, afford a glimpse of surveyors and survey.

TO WILLIAM DWIGHT WHITNEY

SAN FRANCISCO, *November* 14, 1863.

MY DEAR WILL, — As this is the anniversary of the day we were put ashore to grapple with the geological structure of an unknown region of unlimited extent, three years having, if not rolled, at least hitched and scrambled by, since we disembarked as aforesaid, I think it no more than fair to use a portion of this day in writing home, even if my letter bears rather a sombre impress from the recognition of the fact that three years have not sufficed to do up the geology of the western half of the continent — much as we have sweated to bring that desirable end about.

I returned day before yesterday from the field, having been engaged for the last three weeks in measuring a section parallel to the axis of the Sierra, and about forty miles to the west of it. Brewer is still near Crescent City. . . . Hoffmann is sixty or seventy miles southwest of here, finishing up a corner of the Bay Map, which had remained for the last year undone.

By the way, that map of the Bay [of San Francisco and vicinity] is a beauty. I think all will acknowledge it to be the handsomest and most correct map, of any as large an area, ever gotten up in the United States, unless by the Coast Survey. We propose now to commence on the map of Central California, scale three miles to the inch, size about five feet square, to include all the principal gold regions, the main body of the Central Sierra, and the eastern slopes as far as Virginia City. This map, I calculate, will take four years to finish . . . and the topographical work this winter will be a sort of preparation for that. . . . But I won't go into detail now, lest my letter become as long and as dry as a geological report.

TO PROFESSOR G. J. BRUSH

November 15, 1863.

MY DEAR BRUSH,—. . . We are just commencing our spring rains (spring commences here about the middle of November) after a very dry and dirty time—as you might have realized, had you seen me two or three days ago, rolling under my mule in dirt about twelve inches deep, with a barometer on my back at that.

We are gradually coming in from the field now. Brewer is at Crescent City, waiting for a "hypothetical steamboat" to come down. As the line is withdrawn, he will probably come down on a practical stage-coach, after a few days more waiting. . . . They have had a glorious trip. . . . They were on Lassen's Butte at sunrise of a perfectly clear day, and the view must have been stupendous. Gabb is on Vancouver's Island, and will return in a couple of weeks or so, with a quantity of light on the geology of Oregon and the region north.

I hardly know what we shall do this winter; but the first thing will be to color a geological map of the state . . . and admire the fearful gaps in our knowledge of the range and extent of the formations. . . . I shall make no strenuous objection, before the legislature, to a discontinuance of the survey. If it is continued, I shall proceed to publish a preliminary report, and also commence the publication of a volume of paleontology, which will constitute a part of the final or permanent report. If no farther appropriations are made, I shall get what materials I have into shape; and publish as well and as much as I can find money to pay for.

The action of the legislature which came together in the winter of 1863 was especially momentous for the survey. By the constitution of California, all offices created by the legislature expired by limitation after four years, and since under the new constitution the legislature itself met only biennially, the size of its appropriations took on a double importance. The new bill was distinctly less ambitious than the old. It suppressed the agricultural, botanical, and zoölogical sides of the survey; it slighted the general geology, and directed the State Geologist to devote his farther efforts "to a thorough and scientific examination of the gold, silver, and copper producing districts of this State" and to "such scientific and practical experiments as will be of value in the discovery of mines and the working and reduction of ores." It cut the stipend of the State Geologist to $4500, allowed him pay for two assistants, $5000 a year for expenses, and $6000 toward publishing two volumes of his report. The precise details of the appropriation, however, were of no very immediate concern to one to whom the state was wont to be ten and twenty thousand dollars in arrears.

The act was approved April 4, 1864, and on May 13 the State Geologist and his family started for the East to superintend the printing of his reports; for printing in California cost three times its proper price, and engraving was not to be had on any terms. The field work which remained, he left to his assistants.

Unfortunately, the field of the California Survey now included only "the gold, silver, and copper producing districts," while the most pressing of its unfinished tasks was to map the unexplored mountains to the south of Mts. Dana and Lyell. There remained, however, a small sum from the last appropriation under the original act, and this served to cover the expenses of the field party, and to do something toward the salaries of the scientific staff. When that was gone, the men worked for nothing.

The survey was, on the other hand, unusually fortunate in its volunteer assistants. Clarence King and James T. Gardner, recent graduates of the Scientific School at Yale, and pupils of Dana and Brush, having leisure, means, and much thirst for adventure, had come across country with an emigrant train to California. On their way over the mountains on foot from Virginia City, in August of 1863, they happened across Brewer who, having worn down his exploring party to a single packer, was easily persuaded to take on King for the expedition northward to Lassen's Peak and Shasta. The next year, Gardner also volunteered, and with them went as packer a young Irishman of twenty, Cotter by name, whom they had picked up on the emigrant train. Nothing could have fallen out better under the circumstances. Gardner, under Hoffmann's training, soon became a skilled topographer. Something of King's quality appears in the fact that after three years under Whitney, and by the time he was twenty-five, he was head of the United States Fortieth Parallel Survey. King could climb any surface to which human fingers and toes could cling; and wherever he could go, Cotter was ready to follow him.

One would like to dwell on the campaign of 1864, and relate how Brewer, with the disabled Hoffmann tied to his horse, made his way through the wilderness from the headwaters of the San Joaquin to the Yosemite trail; or how, when lack of food stopped the main party at Mt. Brewer, King and Cotter, a week's provisions on their backs, one blanket and one barometer between them, lowered themselves by ropes into King's River canyon, camped without fire above twelve thousand feet, ate their food frozen, climbed Mt. Tyndall, and saw from its top the peak which has turned out to be the highest in what was then the United States.

The campaign of 1864 was a splendid piece of adventure, and its scientific results were no less splendid. It established the age of the gold-bearing rocks of California, and it added to the map of California a region as large as Massachusetts and as high as Switzerland. Whitney had forbidden his subordinates to name for him the mountain which is now called after the Rev. Lorentine Hamilton. This time, in their chief's absence, they stood upon their rights of discovery, and called their great peak, Mt. Whitney, knowing only that if Mt. Shasta had a rival in California this was it.

It was an unusual set of young men who took the field under Whitney between 1860 and 1865. Their chief had picked them carefully; their work and their loyalty to him and to the survey amply justified his choice. One tie they had in addition to their common toil — they were about the only persons in California who were concerned with the earth, and were not trying to make money out of it. On this point the rule was absolute. No member of the survey should use his knowledge of California geology to make a penny for himself. So long as they ate the bread of the state, their information was the survey's, and the public's, not theirs. Such a self-denying ordinance may be a strong bond among men. It becomes doubly strong when men see their leader deliberately turn his back on a fortune, rather than break his lifelong rule never, so long as he might be called upon to give an opinion upon one mine, to own the least part of any other.

The toilsome, happy life of these first years of the survey, has left its mark on the map of California and in the museums of the world. Mt. Hoffmann, Mt. Gabb, Mts. Gardner and King, Mt. Rémond, Lake Eleanor, attest the regard of the topographers for one another and for the naturalists; *Helicoceras Breweriana*, *Mactra Ashburnerii*, *Flabellum Rémondianum*, and a dozen other Cretaceous fossils mark as many of the supreme moments of a collector's days. The paleontologist was a distinctly loquacious person. One can imagine, then, the laughter of these lean, brown men when Dr. Cooper, the serious, the unbending, announced that he had discovered a new species of the old brachiopod genus, *Lingula;* and that in honor of his friend William More Gabb, he had bestowed upon it the name of *Lingula Gabbii.*

Whitney himself had no marked gifts for pleasing his official superiors; but toward his subordinates he was a different man. At each new camp, he was the first to be out with his hammer; and in the wise and genial talk around the evening fire, he was less the State Geologist of California than the gay Apothecarius of Clover Den. He was kindly, just, unsparing of himself; and his associates gave him not merely esteem but affection. With one of them in particular, he formed at this time one of the enduring friendships of his life.

Baron Friedrich von Richthofen was fourteen years younger than Whitney. He had come to California shortly before he was thirty, chiefly to study volcanic phenomena, and having some private means, worked only irregularly for the survey. Modest, sincere, affectionate, he had for Whitney a worshipful admiration, which altered to a regard no less ardent as Richthofen himself became one of the first of living geographers. Richthofen's geological survey of China was Whitney's idea; and during its progress, Richthofen's reports of his doings reached the world by means of long letters to his friend and adviser. These Whitney edited (for the Baron never quite mastered English) and transmitted to the American Academy and other learned bodies; and when the Japanese government called upon Richthofen for plans for its national schools of geology and mining engineering, it was Whitney who provided the American data. Often used the Baron to recall the New Year's eve, between 1867 and 1868, when he and Whitney sat up all night and planned the China Survey.

CHAPTER IX

THE MIDDLE YEARS OF THE CALIFORNIA SURVEY. 1865–1869

THE three and a half years which comprise the first period of the California Survey had been a time of ceaseless activity for the State Geologist. He had lectured each year formally before the state legislature, and from time to time before other bodies; he had labored privately with legislators and citizens. He had carried on an extended correspondence with members of his own family and with various men of science in the East. His yearly report to the Governor kept the public acquainted with the progress of his labors; he had communicated with the scientific world through the "American Journal of Science." He served as chairman of a commission which drafted a plan for a State University, with a School of Mines, a School of Agriculture, and a State Museum; and he spent not a little effort over the California Academy of Sciences, which Dr. Trask and a little handful of devoted naturalists had founded in 1863, the first scientific society west of the Mississippi. His duties had varied from running down the report of a meteorite in the fastnesses of the mountains, to rescuing a surveyor whose instruments had been held up by the custom house. By one means and another, he had kept his survey steadily at work on an average yearly appropriation of less than $16,000, and made one dollar do the work of two in a land where it seldom attained the efficiency of fifty cents.

It was, therefore, with no little relief that Whitney settled down for a year and a half at Northampton and Boston, "hearing much music after the long fast, . . . dining with Judge Hoar, Norton, Longfellow, Lowell, Holmes, etc.," honored by the growing friendship of Agassiz. He had, moreover, the satisfaction of knowing that the scientific world approved his work. He was made head of the projected School of Mines at Cambridge, with indefinite leave of absence, without salary, to attend to the California Survey; the American Philosophical Society made him a life member; he was one of the fifty eminent men chosen in 1863 to form the National Academy of Science.

A few extracts exhibit Whitney's states of mind in an uneventful time.

George W. Julian, Member of Congress from Illinois, had consulted Whitney in regard to his bill, then before Congress, on the mineral lands belonging to the government.

TO HON. GEORGE W. JULIAN, M. C.

BOSTON, *January 12, 1865.*

MY DEAR SIR, — In reply to your favor of the tenth . . . I would state that I have given much thought to the subject of the policy of the Government in regard to the management of the mineral lands, as I believe it to be a subject of vast importance to the country. I have accumulated many facts which demonstrate, in the most conclusive manner, that the most profound ignorance of everything connected with the subject exists in the General Land Office and the Census Bureau, and that the Government is likely to be greatly misled and may do a great injury to the country, if it allows itself to be guided by recommendations emanating from the Department of the Interior. . . .

I have not yet been able to see how any plan could be devised by which the mineral lands of the United States could be sold; although I am not prepared to say that such a one might not be. Nor am I certain that a general code of mining laws might not be made by Congress, based on the Mexican system, which would meet the difficulty. . . .

In my lectures and addresses in California, and in my paper presented to the National Academy of Science at its last meeting, I have shown that the progress of California had not been what it should be, as compared with that of the Province of Victoria in Australia; and after comparing all the conditions of the two countries, I have been led to the conclusion that it is the defective system of management of our public mineral lands by the Government which has put back our development so much. . . .

In addition to the chronic differences of opinion between the Californian geologists and the Californian speculators in mines, a short-lived boom in oil lands, contemporaneous with the oil excitement in Pennsylvania, threatened "to kill the survey as dead as a door-nail"; for, as usual, there were marked discrepancies between the prospectuses furnished by promoters and the data given out by the survey.

TO WILLIAM DWIGHT WHITNEY

BOSTON, *March* 10, 1865.

DEAR WILL, — . . . Some high officials have called on me; and not finding me at home have poured out to Louisa their sorrows at having been swindled. . . . If you consider that $40,000,000 or so of bogus, worthless mining stock has been set afloat, indorsed and guaranteed to be of the highest value . . .

(two companies alone have $20,000,000 capital), you will see that it is no joke. Ashburner has been down to the "Petroleum Region" . . . and says it is all a humbug, and all the San Francisco papers implicitly admit the same thing. Everybody has known that there was *asphaltum* in California in abundance, and many attempts have been made to get oil from it, and to get oil by boring, but all have proved failures, although some hundreds of thousands have been expended. [Francis Humphreys] Storer — to whom I referred the matter for examination, two years ago, with a statement of facts — reported that the asphaltum did not furnish a valuable oil for illumination. He says that asphaltum precludes the existence of petroleum: they are entirely different articles. . . .

It is not for me to act in the matter; I am too much an interested party; if . . . reports are correct, I am an idiot and should be hung as soon as I get back to California.

TO J. N. HOAG, SECRETARY OF THE CALIFORNIA BOARD OF AGRICULTURE

BOSTON, *May* 15, 1865.

. . . As far as I am personally concerned, I should have no objection to furnishing an article annually for the Report of the California Board of Agriculture. My whole time is given to the service of the state and I should be perfectly willing to use a portion of it in the way you propose, if the legislature will authorize it. You are mistaken, however, in supposing that such a thing can be done "without labor." I am not one of those who can scratch off an article of permanent value in a few hours' time, especially on a subject of so much difficulty as that of the geology of California. In fact we are ourselves only learners in that field. With four years of the most persevering labor, we have only just begun to get an outline of the geological structure of the state, and it remains to be seen whether we shall have permission from the next legislature to go on and try to fill it up. The survey of New York, commenced in 1836, is still going on, nor do I suppose that it is expected to be completed in less than ten years; and yet, while California is four times as large as that state, and while her geology is ten times as complicated, I have no doubt that we are looked upon, by many, as blunderers because we have not already got through with our job!

If Governor Low thinks there is no objection, I will endeavor to prepare an article as above for the next Report. I must add, however, that although, in my own case, I am already paid by the state and would accept no farther compensation, I do not believe that the other gentlemen associated with your work, should be expected to contribute their labor gratuitously; nor do I consider that anything of value will be obtained unless they are paid. I have never observed that people were in the habit of working for nothing in California, and there are certainly few scientific men there who are rich enough to be able to do so.

Very truly yours,
J. D. Whitney.

Governor Low approved the project, June 20. The reports were out of the way by the end of October, one large volume of five hundred pages on the general geology, one on the paleontology, — on economic geology nothing. Whitney at once set sail with his family for California, despatching from the steamer a last note to his brother.

TO WILLIAM DWIGHT WHITNEY

On board Henry Chancey, off Cuba, *November* 6, 1865, in white pants and straw hat.

Dear Will, — . . . I had an interview with Baron Stöckl at New York, who is bent on recommending to his government (he is the Russian Ambassador, you know, if you can read the name) to have a geological reconnoissance made of Russian North America under my supervision. He seems very much in earnest about it and was overwhelming in civility. . . . I did n't say yea or nay. I did say that I thought valuable mines of the precious . . . metals would be discovered there. So much the geology of the country justifies me in saying.

The romantic days of the survey were now over. The first four years had "skimmed the cream" by solving most of the greater problems. There remained the painstaking detailed work of an ordinary geological survey, enlivened by an occasional unexpected find, or by an excursion *in partibus infidelium*. One great problem, nevertheless, remained — the antiquity of the human race on the Pacific coast. Whitney, in addition to his other labors, turned anthropologist, and followed up every find of human remains. It was an especially important question just at this time, when the caves of France and Belgium were yielding up their evidence, Darwin was at work on the "Descent," and Lyell just bringing out the first edition of his "Geological Evidence of the Antiquity of Man."

In the meantime, there were changes of personnel in the survey. Various new men came on. Brewer went East to his professorship at

Yale. King and Gardner were loaned to the United States Government for the exploration of Arizona, where "they had an escort to protect them from the Apaches, but . . . needed additional assistance to protect them from their escort." There were now eleven different publications of the survey either on sale or under way; while the State Geologist, in addition to his responsibility for the California State University on one side of the continent, and the Harvard School of Mines on the other, was now president of the California Academy and head of a new-made board of three commissioners to manage the Yosemite Park.

TO WILLIAM DWIGHT WHITNEY

SAN FRANCISCO, *January* 9, 1866.

. . . As soon as I receive the expected vol. (I), I am going up to Sacramento to see how the land lies. . . . Mr. Gabb has gone to the southern part of the state to look up some doubtful geology, collect Tertiary fossils, and examine into the progress of the oily interest. Rémond will leave us for Chili. He expects to return again, but I think it extremely doubtful if he does, as his lungs are much diseased. Like many consumptives, he keeps up good courage and imagines he will get well. Gabb, Cooper, and Rémond are all consumptives, but Gabb's health has improved since he came out. No doubt California air and outdoor life have helped him much.

I hear from Cambridge that the mining school is progressing favorably; and they talk of putting up a building, as soon as we can agree on a place.

TO WILLIAM DWIGHT WHITNEY

SAN FRANCISCO, *February* 8, 1866.

. . . As an old *Zuhörer* of Bopp, I shall be glad to subscribe to the Bopp *Stiftung*, as you suggest, and leave it to you to fix the sum, get the money from Father, and otherwise do the needful. I shall never forget that I too might have been, or become a Sanskritaner!

TO WILLIAM DWIGHT WHITNEY

SAN FRANCISCO, *February* 17, 1866.

MY DEAR WILL, — . . . My own health is somewhat better than it was when I wrote last; but I am far from well. Anything like worry of mind always affects me physically, and I cannot help being worried about the survey. There is so little appreciation of, or care for, anything but money-making in this state, that it is terribly up-hill work to drag this concern which I have been pulling at for five years, up the hill of difficulty. It is hard enough work to do to carry on the survey even if it were appreciated and no obstacles were placed in my way. While I could not help being secretly gratified, or at least relieved, if the survey were stopped, yet my scientific instincts make me fight for its continuance.

Strictly in confidence, let me say that they have sounded me from Columbia College to know if I would take a professorship. I have made no reply. . . . I consider, however, that I am bound to Cambridge, if they raise money enough to pay me a salary — as I suppose they will do when I am ready to go. . . . On one account . . . it would be much easier in New York, as all I should have to do there would be to lecture and instruct in geology, and I should not feel that I had the concern on my shoulders as I do at Cambridge. . . . The mining speculators are as bitter against me as ever, and every unfavorable report by any mining engineer is always laid at my door — or at least I get cursed for them all.

TO WILLIAM DWIGHT WHITNEY

San Francisco, *April* 4, 1866.

My dear W. D. W., — . . . My four visits to Sacramento have not been without fruit; indeed I have devoted a large portion of the last two months to "pulling the wires" of the legislature. For the first time my appropriation bill went through without a word of dissent in either branch. . . .

The Assembly Committee on Mines recommended $30,000 and that was inserted in the general appropriation bill by the Committee of Ways and Means. At the same time the Chairman of the Mining Committee expressed himself as highly favorable to the survey, but thought that they could n't carry over $30,000 through the House. After the bill had passed the Assembly, I went up and coaxed the Chairman of the Finance Committee in the Senate to introduce an amendment, adding $15,000 for printing and engraving. This was done, and my friend C. B. Porter of Contra Costa, a real backer-up of the survey, deserves a large part of the credit of inducing the usually flinty-headed Chairman to let this go in. The amendment slipped through the Assembly without opposition and almost, or quite, without notice. . . . The $45,000 is a larger sum than has ever before been appropriated "at one lick," and besides I have the advantage of not being hampered in any way in the spending of it. It is mine to do just what I please with. . . . Still $15,000 a year is a small sum with which to do all I would like to accomplish.

TO WILLIAM DWIGHT WHITNEY

San Francisco, *July* 18, 1866.

. . . The great excitement now at the office is the discovery of a human skull at a depth 153 feet below a series of volcanic beds with intercalated gravels. I have just returned from the locality, and we have the skull at the office. It is a bony fide find of the greatest interest, all the particulars of which I shall work up with the greatest care.

Thus ran the first report of the far-famed Calaveras Skull, probably the most discussed of all relics of primitive man on the western continent. Whitney himself maintained it to be proof of a Tertiary race going back to the times before the great lava flows when the present mountain tops were valley floors. Certain believers in special creation insisted that its original owner was one Jo Bowers, an ill-fated miner of early Californian days. The question of its real age has never been absolutely settled, but general scientific opinion is rather against the extreme antiquity which Whitney assigned to man on the Pacific coast. There is, moreover, some doubt whether the skull now in the Peabody Museum at Cambridge is really the original find of 1866.

TO J. D. WHITNEY, SENIOR

SAN FRANCISCO, *July* 28, 1866.

MY DEAR FATHER, — The survey is going now on a large scale: two parties are in the field and another one is about to start. This one I shall myself accompany for a time, until they get their work well under way.

My staff at present consists of Messrs. Gabb, King, and Hartwig as geological assistants; Hoffmann, Wackenreuder, and Gardner, topographers; Brinley and Coffey, barometrical observers and general sub-assistants; Bolander, botanist; Cooper, zoölogist. There are, besides, some twenty or thirty persons engaged in drawing and engraving at the East. So you see that I have my hands pretty full to manage all these, especially as my forces are so scattered abroad.

We have been very much troubled because our good friend Dr. [Martin John] Burke has not been renominated for the office of Chief of Police. The roughs have got possession of the city government again, after being kept out for ten years or more, and I fear that we are going back to the old days of rowdyism and crime. I feel more disgusted with California than I ever have been before, even when the state was $15,000 in debt to me. By the way, they are not paying up very promptly now. . . .

TO WILLIAM DWIGHT WHITNEY

San Francisco, *January* 18, 1867.

. . . Music, with me, is a thing of the past. I neither play nor sing, and in our family the music has gone down to another generation, and my only connection with it is to pay Nora's bills. Concerts worth hearing are entirely unknown here, and the opera is atrocious; . . . I believe that four is the number of my attendance on concert, opera, theatre, or public amusement of any kind, since I first came to California; and one of those times was this week at the Japanese performance of gymnastics and acrobatism (if there is such a word). Everything about this was curious and interesting.

. . . Of late I have been much engaged with the affairs of the California Academy, as we have had to move into and fit up new rooms, and have tried to resuscitate in general. We seem now to be in a fair way to live; but when I came back last year, it seemed as if it was as dead as a door-nail. We have now a pleasant reading-room, with a goodly number of scientific periodicals; and are fitting up our meeting-room and collections in a respectable manner. The last sheets of the Proceedings . . . will tell you what we have been doing, and you will notice my account of the Skull, etc.

TO WILLIAM DWIGHT WHITNEY

San Francisco, *March* 8, 1867.

My dear Will, — You can now realize the fact that a man who has only just turned forty is a mere boy; it is only the old chaps just approaching the fifties who are the patriarchs. You will realize that I am getting pretty old, when I tell you that I have left off smoking — not having had a cigar or pipe in my mouth for the last two months. I see your book advertised by Trübner, and suppose it will be out "by and by" like the reports of the Geological Survey.

It was on account of the assurance I received from Gabb, Ashburner, and Osgood [Putnam] that the survey was killed by the discovery of vast quantities of petroleum, which we had overlooked, that I concluded to turn my thoughts to Harvard. Now, since all [such] statements have been proved to be lies, and never a drop of oil found in the . . . ranch where . . . there were "fabulous quantities," there is more confidence in the survey than ever.

Gabb writes me in frantic language about the meanness of —— in his behavior to their party in Lower California. . . . According to Gabb's account the country is horribly dry, barren, and uninteresting — and what is worse, destitute of fossils.

TO WILLIAM DWIGHT WHITNEY

San Francisco, *May* 9, 1867.

My dear Will, — *L'homme propose, Dieu dispose*, as the fact of my being in S. F. at this time clearly demonstrates. In vain I keep my saddlebags packed: I get no chance to put them across horse or mule. It is just as much as I can accomplish to keep straight the work of others, especially when every detail has to be watched with the utmost care. . . .

All the work here is going on as fast as I can urge it, and I shall soon have spent the sum total of the appropriation for the next fiscal year ending July first, 1868!!

TO WILLIAM DWIGHT WHITNEY

San Francisco, *May* 12, 1867.

. . . Tell Brewer that I expect Rémond up by the next steamer with a great lot of interesting things. But I have little hope that he will ever do any more work; it is evident from the tone of his last two letters that his time is nearly up, and that he begins to realize it himself. What a contrast between his position and that of King, coming up in the same vessel,— the one just at the opening of as fine a career as ever was offered to a scientific man; the other with finer natural abilities by far, but cut off just as he is beginning to make his mark in the world. Poor fellow! I pity him from the bottom of my heart!

Rémond died before the end of the month.

The "we" of the next letter includes only Mrs. Whitney and her husband, who have at last found opportunity for a long-planned excursion north.

TO WILLIAM DWIGHT WHITNEY

SAN FRANCISCO, *July* 20, 1867.

MY DEAR WILL, — Our journey was quite a successful one as far as health and pleasure go: I wished very much for more time, however, as one month is very little to see Oregon, Washington Territory, and British Columbia in. We were gone just thirty-two days. By sea to Portland, stop there a day, then up the river to the Dalles and back to Portland, . . . across by land to Olympia, head of Puget's Sound; then by boat touching at all points on the Sound to Victoria, . . . New Westminster and back; then to Salem by boat, then by stage to Dorvill, California, and home by railway and steamboat . . . stopping over about thirty hours at Yreka to rest and have a good look at Mt. Shasta. We rode two consecutive nights in a road wagon, never stopping from the time we

MT. RAINIER (14,363 ft.)

left Salem until we reached Jacksonville [the air line distance is 175 miles], when we had six hours' rest. I was not tired at all when we reached S. F., nor does Louisa seem to have had any ill effects from the journey. . . .

I was extremely anxious to go farther up the Fraser River: but it seemed as if one month was all that I could take for my absence. I got many geological facts of interest to supplement Gabb's work of 1864 and 1865.

Of course, one of the great points was to see the big mountains, Hood, St. Helens, Adams, Rainier, and Baker; and we were favored by the weather so that we saw them all to advantage, especially the three nearest the Columbia. . . . The view of Rainier from the boat as we passed the head of an arm of the Sound . . . produced an impression of greater height and grander mass than either of the other mountains gave. But the position of Rainier is not sufficiently well fixed to enable me to get an idea of its height. . . . I should think, however, judging by the eye, that it is the highest of all the Oregon and Washington mountains. . . . My arrangements had all been made to ascend Hood; but on seeing [Col. Robert S.] Williamson, I found that he intended to send a party up in August better provided with instruments than I was. So I left the work for him to do, which I was the more inclined to do, as I found that it would cost me about $200 and ten days' time to make the trip, while it was too early in the season to have a good chance to examine the rocks, as the snow came almost down to the base of the mountain.

I was convinced from all that I could learn, that there is no difficulty or danger in going up any of these mountains, and that the cock-and-bull stories told by W—— and others are all humbug. The measurement of Hood published by W—— was in reality made by Rev. Mr. Atkinson of Portland, who carried up his thermometer, one . . . with a heavy metallic scale, and who made the observations and calculated them by a rule given in "Porter's Chemistry." Of course, under the circumstances no sort of approximation to the truth could have been expected. The best joke is that Rev. Mr. H——, whose pretended measurement, as communicated to the Royal Geographical Society, is noticed in the May number of the "American Journal [of Science]," never carried up any instrument at all, as I ascertained from those who went with him.

The views of Hood, St. Helens, and Adams, from near the mouth of the Willamette in a clear day, are indeed wonderfully beautiful. The mountains impose on one exceedingly because they rise so high above their bases. . . . All have been ascended except Rainier. . . .

If we have taken down Mt. Hood considerably, I regret to say that we have done the same by the Big Trees. The trees in the Mariposa grove have all been plotted and measured, and not one of them reaches three hundred feet. The highest is 272. . . . In the Calaveras grove there are two, and two only, which exceed 300 feet. . . . J——'s measurements are all wrong—from thirty to sixty feet out of the way! . . . By the way, D'Heureuse [an assistant of the survey] has discovered a monstrous grove of Big Trees . . . on the head of Tule River; the largest eighty-three feet in circumference. He has not sent me a full account yet.

Gabb and party are somewhere between the White Mountains and Death Valley. . . . I hope they are doing well; but they have a hard job before them. I intend to go out to meet them in about three weeks, to see how they are getting on and help in some of the astronomical work. We go next to the Yosemite, Hoffmann and I with Louisa and Nora.

TO WILLIAM DWIGHT WHITNEY

September 17, 1867.

. . . I had a most interesting trip [in southern Nevada]; but did not find Gabb and party, and presume they have gone far south of all settlements . . . straight across to . . . the southeast corner of the state. . . . The fact that bad news always travels fast, leads me to believe that they have not come to grief; but I shall be much relieved when news from them turns up.

Although I failed to meet Gabb, I accomplished a good deal, considering the shortness of the time; saw the mines and mills of Austin and vicinity, got a general idea of the geology and physical character of the country, and enjoyed the trip very much, spite of alkali dust and heat. On the way out, at the first station beyond Virginia City, we were gone through by the "road agents," i. e. highwaymen, in the neatest and most scientific manner. . . . They took from me a little over $200, but left me my two chronometers, so that I felt, on the whole, as if I had rather made money by the operation.

Hoffmann is getting on finely with his party. They are now in the big canyon of the Tuolumne, and will be back here in about ten days. You and Brewer will be glad to learn that they have a lot of fine photographs of the High Sierra, glacial surfaces, moraines, and all that. They were in the region of soda springs, up Mt. Dana, etc., and got photographs from those points.

TO WILLIAM DWIGHT WHITNEY

San Francisco, *January* 27, 1868.

. . . The last steamer brought 50 copies of the Bay map from Bien, *au naturel*, the swamps a little blurred by rapid printing, but otherwise looking very well. It was lucky that they came as they did, for I go up to Sacramento on Wednesday to address the legislature, and should have been very sorry to have failed to have some copies of the map to show. I had two or three gaily colored and mounted and can now sail into the legislature with flying colors.

. . . If the legislature does not respond pretty soon to my address, I shall commence packing and getting things in order for an eastward march. The disgust with California that I have had since the legislature voted to ask Congress to give the settlers in the Yosemite Valley 160 acres of land apiece, has been so great that I feel less inclined than ever to remain here. The hope that the Governor will veto the bill is my consolation at present. But even if he does, the whole proceeding shows such a depraved condition of public feeling... that the legislature, the state, and the people have become disgusting to me. I am afraid that I shall be saucy in my address, but I cannot help it. The Governor [Henry H. Haight] is all right on the survey question, as he took occasion to inform me by letter.

TO WILLIAM DWIGHT WHITNEY

SAN FRANCISCO, *February* 26, 1868.

. . . The prospects of the survey remain as uncertain as ever. Two committees have been at the office and exhibited even more than their usual amount of stupidity and ignorance. Since the Yosemite Valley bill passed over the Governor's veto, I feel so disgusted with California that I can hardly stand it much longer. Still I am running the survey along in a small way at my own expense, waiting to see what the jackasses at Sacramento will do. . . .

. . . I am told, on good authority, that this legislature is by far more corrupt and reckless than any of its predecessors. It is a fact — at least everybody believes it to be — that votes can only be had this year by purchase. I have been semi-officially notified that I must come down with $2000, if I want my bill to pass. Considering all the circumstances, I do not think it prudent for me to expend any more money on the survey; and unless you have received a telegram from me to the contrary before you get this letter, you will please to make no more payments for the survey without my special authority. . . . I have written to Gabb to discontinue his work, and to Baird to do the same, unless he receives telegraphic information through you, to go on, before my letter mailed by this steamer reaches him.

While Hoffmann and Wilson were down at Santa Barbara on a private survey, I got them to make a detailed topographical survey of the "oil region," that is, of those ranches where all the work was done during the excitement in the way of procuring petroleum by tunnels. Everything is deserted there now; and they admit that it would not pay to barrel the stuff, if they had it on the surface all ready to hand.

TO WILLIAM DWIGHT WHITNEY

San Francisco, *March* 29, 1868.

We have had a nice little time of it in the legislature. The petroleum and other swindlers made a dead set on the survey and killed it, having malleable material to work with in the Democratic legislature. . . . A deficiency bill of $15,000 appropriation to wind up the survey with, passed the Senate, but it is doubtful whether it is reached on the Assembly's file before adjournment. If that does not pass, all the property of the survey is left on my hands to pay myself with. The committees in the Assembly and Senate both made favorable reports and recommended large appropriations; but the swindlers are too strong. We were especially unfortunate in having in the Senate a man, the fugleman of the Democracy, a veteran politician and a former United States Surveyor General, under whose administration the fraudulent surveys in the southern part of the state were made, and the character of which is being exposed as fast as our work covers the ground. Of course he fought against us with all his might.

TO WILLIAM DWIGHT WHITNEY

SAN FRANCISCO, *April* 13, 1868.

. . . For the past few weeks I have been packing and winding up business with 40-horse power speed. . . . We have concluded to sail on the 30th of this month. . . . We have wound up housekeeping, sold out our furniture, and moved to a hotel — a big job. Are now packing at the office and storing the collections away. . . . Everybody thinks that the next legislature will repair the damage done to the survey as far as possible: the indignation at its stoppage is very general. There is a good deal of talk of raising a private subscription to carry on the work. Perhaps I may get enough to publish two or three volumes during the next two years.

"Petroleum" is what has killed us. By the

MT. HOOD (11,932 ft.)

As seen from Portland, distant 50 miles

word "petroleum," understand the desire to sell worthless property for large sums and the impolicy of having anybody around to interfere with the little game. . . .

The situation of the State Geologist of California was now a most embarrassing one. The legislature had neither stopped the survey, nor continued it. All the property of the survey, the finished and unfinished publications, had simply been left on Whitney's hands, with neither means to continue any part of his work nor authority to bring it to an end. Fortunately, however, he had the loyal support of Governor Haight, who encouraged him to believe that a later legislature might be persuaded to repair the damage done by this. Whitney, therefore, stored the collections under charge of Hoffmann; and with them such of the instruments as von Richthofen did not carry off to China.

Whitney himself hired the furnished house of Professor Asa Gray at the Botanical Gardens in Cambridge, and settling down to the uneventful life of a university teacher, he got the new Mining School under way, and brought out at his own expense, two more volumes of the California Survey, the second of the paleontology, and a popular scientific guide to the region adjacent to the Yosemite Valley.

CHAPTER X

THE LAST YEARS OF THE CALIFORNIA SURVEY. 1869–1874

Two years Professor Whitney stood to his teaching before he turned once more to the wilderness. There were four students in his first class at the Mining School, the class of 1869; and by way of rounding off their professional training, Whitney set them at work on an unsolved problem in geography on which he was himself engaged. There were rumors in geographical circles of eighteen-thousand-foot peaks in central Colorado, at the culminating point of the Rocky Mountains; of peaks therefore, which certainly rivaled, and which might surpass, the high places of the Sierra Nevada and the great volcanoes of the Pacific coast. During the winter and spring of 1869, therefore, Whitney took his four apprentices into his study, to struggle under his practiced guidance with the discordant evidence of travelers' tales and government reports. After they had learned all that was to be had from books, they were to attack the problem on the ground.

Whitney himself, Brewer, and Hoffmann were the backbone of the summer field party;

and besides the four students there were two instructors from the Mining School. They took up their mapping on the main ridge of the Rocky Mountains west of Denver, and by the end of the summer had settled the main features of its topography. The usual results followed. The eighteen-thousand-foot summits, fairly confronted with barometer and level, promptly shed a fourth of their reputed height, and shrank to the dimensions of the California peaks. The accurate measurement of high mountains, however, is a difficult art; and Whitney, in general, tended somewhat to exaggerate altitudes. But his estimate of relative heights has turned out to be pretty correct, while a mistake of even five hundred feet may be forgiven to one who is correcting an error of five thousand. Mt. Harvard, Mt. Yale, and Mt. Princeton, three great peaks of Colorado, are among the mementos of the summer of 1869 when Hoffmann taught four students to handle a transit.

All through the suspension of the survey, Whitney had been encouraged to hope that the legislature of 1870 would reverse the action of that of 1868, and order a resumption of the work. As soon, therefore, as the new legislature convened, Whitney repaired to California and laid siege to the new body. Of his scientific friends in the East, Dana, Henry, Guyot, and Agassiz gave special aid; while of the Californians, Leland Stanford lent the weight of his very considerable influence and Edward Tompkins, who was state senator, took charge of the details of the campaign. Governor Haight was, as always, favorable. Among them the bill went through.

Meanwhile Professor Asa Gray returned to Cambridge and claimed his house. Luckily, however, Whitney's old friend and cousin by marriage, B. A. Gould, was made head of the government observatory in the Argentine Republic, and left vacant for the Whitneys his house at 12 Oxford Street. To the question, therefore, where he lived, Whitney made answer: "I am staying [in Boston] at the Parker House; my family is in Brookline; I have a house in Cambridge; my library and collections are in Northampton, and my office and business at San Francisco." That year Whitney crossed the continent four times.

TO F. VON RICHTHOFEN, AT SHANGHAI, CHINA

SAN FRANCISCO, *July* 14, 1870.

DEAR BARON: —

. . . .

I think I wrote you of the passage of the survey bill through the legislature with an appropriation of $48,000 for two years, besides $25,000 to pay arrearages.

We are all under full headway now. Hoffmann and party, with Goodyear as geologist, took the field in April and have been exploring the Inyo Range and north to Mono Lake, on the east side of Owen's Valley. They are now at Aurora. I am going to join them, and cross the Sierra, exploring the region between the Tuolumne and the Stanislaus. There is also a party mapping the detailed topography and geology of Yuba and Nevada counties, and Wackenreuder starts out in a few days to finish up his work. One quarter of the Central California map is nearly engraved, and is a very fine piece of work. The first volume of the "Birds" is going through the press, and the sheets, as printed, go to the colorist in Philadelphia, who is busily at work on them. The work on the Botany is being busily pressed forward, and Brewer will give his whole time to it, and Professor Gray a large part of his. The worst feature is that there is no money in the state treasury, so that it is pretty tight squeezing to get so big a work along. I went east in May, and have been back ten days. Mrs. Whitney was taken sick shortly after my arrival at Boston and remained in a very critical condition until a few days before I left to return.

She seems now to be gaining, although slowly. I have taken a house in Cambridge and expect to return there in September, as I have to lecture in the University this coming winter, having promised to do so before the continuance of the survey had been ordered. My subject is "Structural and Dynamic Geology." The work of the survey will go on without interruption, however, and I shall return here again in May. I am obtaining additional evidence all the time of the great antiquity of man on this coast, and shall have an interesting chapter on that subject, in the next volume of the Geology.

The hammers, etc., you are most welcome to: I am glad to contribute that much to your great work.

TO WILLIAM DWIGHT WHITNEY

SAN FRANCISCO, *August* 1, 1870.

MY DEAR W. D. W.,—Yours of the 10th of July was found on my table last night, as I arrived, dusty and dirty, from the mountains. Also, among heaps of others, one from Brewer, informing me that my Alma Mater had honored me to a degree [LL.D.] that I certainly never expected. Had I appeared before the Corporation in my yesterday's rig, with begrimed linen duster, skinny and shiny red nose, awfully battered hat, greasy pants stuck in my boots, and so on, what would they have thought of such an object as a recipient of their honors!

However, I had a good time in the mountains, although worried by the mosquitoes and broiled in the sun, between the showers, to a degree that I have not experienced for some years. I found both parties in the field in good condition, and the work progressing in all respects satisfactorily. The survey seems to be firmly on its legs now, and I rather regret that I have promised to return to Cambridge and spend the winter, although the courses of lectures which I have to give will interest me much in their preparation, if they do not my auditors (provided I get any) in the delivery. I suppose that I must go east about the middle of September, and that by the 1st of October we shall be settled in our house. . . .

TO MRS. WHITNEY AT PROUT'S NECK, MAINE

SAN FRANCISCO, *August* 13, 1870.

MY DEAREST PEASY: —

. . . .

I do not "remember at Northampton" that I demurred to what you said about ——. I do not remember that I demurred to anything, or had any ideas on the subject, except such as you put in my head. I only remember vaguely that you said that they never would be engaged, or ought not to be, or something of the kind, because she was taller than he! I never saw —— that I remember; at least I should not know her if I saw her now, but I have a vague idea that she is a nice girl, although I do not know how I got the idea, unless from you. As to her being taller . . . if she is, I do not see that that is killing. A little more, and you would be taller than I. At all events, I wish them well. . . . I am also willing to admit, once for all, that you understand human nature better than I do, although I consider you unsound on the altitude question; and shall believe that you half regret having married a short man who could only be highered up by having letters added to his name like slips of leather on his boot-heels.

. . . The people have gone into ecstasies over Lake Eleanor and the Hetch-Hetchy; and are building trails up there, and say that the scenery is finer than that of the Yosemite. . . .

I do not exactly understand what you mean by your remarks on [Raphael] Pumpelly's book [on his experiences in China, Japan, and Arizona] and King's ascent of Mt. Tyndall. That is just the beauty of Pumpelly's book, that it is entirely true. When he came up from Arizona, all these facts that seem so strange now were well known to us; he knew all those people that were killed, etc., and never was there the slightest reason to suppose that he exaggerated — in fact there was no need to do so. Everybody who went to Arizona had the same experience. . . . Pumpelly was lucky, — others had rich experiences, but unfortunately lost their hair or got too many bullet-holes, and so lost their chance of telling their stories. It is an entire misrepresentation to say that Pumpelly's book is not trustworthy. As for King's credit for climbing Mt. Tyndall, he deserves all he ever got for it; but the credit given a man for first climbing a mountain is very different from that given for scientific discovery or grand scientific generalizations.

The work in California is interesting; but it is difficult and a great deal of physical exertion is required to carry it on. I can do other scientific work which will bring me in just as much scientific reputation as this, without half the wear and tear which this survey demands, and for which I am getting less fitted as I get older. I do not wish to settle down and do nothing outside of my study; but do desire to have less of outdoor work, especially in a climate like this, which I see from its effects on my assistants, if not from my own experience, to be a very trying one.

TO WILLIAM DWIGHT WHITNEY

CAMBRIDGE, *November* 21, 1870.

MY DEAR W. D. W.,— I am glad you like the "Birds" [i. e. the first of the two volumes on the ornithology of California], the colored copies will be "illigant." 'T is a pity that we could not have made our Thanksgiving at Northampton; for, among other reasons, I am afraid that I cannot go up to Christmas.

Work presses, this winter, wusser than ever. My lectures commence on the 29th (Nora's birthday). December 13th I shall hold forth at the Academy on the Antiquity of Man, being myself an ancient (51, day after to-morrow). Eheu! We *are* in a stew about the scientific school, and know not what Eliot and the morrow have in store for us. Meantime, however, I have bought a lot of land, so as to have at least a place to squat on, if only Sunday afternoons when the weather is fine. It is next to [Professor Ephraim Whitman] Gurney's [near the Cambridge reservoir], far, far away from these earthly scenes, and we call the place "Alturas," — that is our fixed determination and nothing can alter us.

The boys continue to report interesting discoveries and good work in California. More facts *à l'appui de l'homme fossile* keep coming in; also a gigantic lama has turned up among our rubbish, whose cannon bone measured 19 inches long, to 13 of the corresponding bone in the camel! Who'll say that California is not the land of giants!

We had a great treat in hearing and seeing Fechter in Hamlet; the first time I ever saw a Shakespearian play performed!

TO WILLIAM DWIGHT WHITNEY

Cambridge, *February* 3, 1871.

I take pleasure in sending you the first complete copy of the "Birds." *If you do not think it handsome please send it back!* Words cannot express how much labor (and money!) it has cost. Some copies will be ready next week bound in ½ Turkey; one for Dana and one for King (to whom I am greatly indebted for photographs, etc.). . . . I am just through the physical geography division of my lectures and begin on climatology as soon as I get back from New York. . . . Just beginning on the little "Yosemite Guidebook"—a pocket edition.

TO WILLIAM DWIGHT WHITNEY

Cambridge, *March* 13, 1871.

. . . The boys are writing all the time to me urging me to return to San Francisco, and I may have to go. I hope not, for I need a little rest after my lectures are over, and have one or two papers to write, one on glaciers, and one on the cause of volcanic and earthquake action, for the "North American Review."

TO WILLIAM DWIGHT WHITNEY

SAN FRANCISCO, *July* 15, 1871.

MY DEAR W. D. W.,—You will perhaps be interested to learn that this child got into Fr'isco safe and sound on Monday last, after a very pleasant passage right through from Northampton. . . . The affairs of the survey seem to have been going on prosperously during my absence, and the map of Central California is now nearly completed and looks very fine. . . . All the assistants will be in next week, and we shall overhaul the geological field work of the past year and see what remains to be done to enable us to color up our Central map. . . .

I got the "North American Review" to-day and read your notice of Müller and "liked it first rate." Hope you will be able to say as much for mine of King's book [" U. S. Geological Explorations of the Fortieth Parallel"]. My article for the October number is in type. . . . The article is decidedly heavy, but has cost me labor and has some points in it which I consider of importance.

Did you notice in the "Saturday Review" of June 24 a tremendous puff of the California Survey? King climbed to the top of Mt. Whitney, *endlich*, and will tell us all about it in his new book ["Mountaineering in the Sierra Nevada"] when it comes out.

It turned out, nevertheless, that King had not climbed Mt. Whitney. He came in on the southeast, from the Owen's Valley side, climbed by mistake the peak now called Mt. Langley, and did not discover that the real Mt. Whitney, 500 feet higher, lay five miles away in the clouds. Mt. Whitney itself, therefore, remained unmeasured and unclimbed, until the summer of 1873, nine years after it had been named, when W. A. Goodyear, a topographer of the survey, corrected all errors and finally identified the peak which Brewer and Hoffmann had seen from afar and named in 1864.

TO MRS. WHITNEY

SAN FRANCISCO, *August 26, 1871.*

MY DEAREST PEASY, — . . . Next Wednesday is the day fixed for starting, and I am glad of it, for I am far from well, and hope that the journey back will do me good. This climate does not seem to agree with me, somehow. . . .

In that long letter I wrote you, I gave vent to some of my feelings in regard to house-building, the survey, etc. This we will talk over when I return. . . .

We are going at a tangent from each other. I want to get settled down in a house, so that I may feel that I have not got to move my traps again, and that I may have, for a few moments at least, the feeling of repose; you want to go and keep going. I propose to compromise, and first secure a place of deposit, at least, of our own; and then start out on a reasonable amount of wanderings. I do think, however, that . . . we shall have to be economical, until we get a house built, and after that until we get a little saved up for traveling purposes. The main thing is that we keep our healths. . . .

If I should feel as poorly as I do now, I should be inclined to go somewhere for a few months, and absolutely throw off all care and work. But I hope that my indisposition is only temporary.

TO MRS. WHITNEY

San Francisco, *August* 28, 1871.

My dearest Peasy,— . . . You agree with me as to the desirability of having a house, and I am delighted that you feel so. . . . If it were for no other reason, it seems to me that on Nora's account we ought to have one. And I am worrying all the time because my books are

MT. ST. HELENS (10,000 ft.)

As seen from Portland, distant 68 miles. Mt. Rainier at the left, 110 miles north

slowly spoiling at Northampton: while the idea of having to move at some time or other, is a perpetual weight on my mind.

There is hardly anybody living who has such a strong desire to quiddle in his own domicile as I have, and yet for thirty years I have been banged about from pillar to post, as if I were lost railway freight. Nobody living so enjoys being with his wife and family; and yet I am separated from mine almost half the time. I am opposed to it; I detest it; I won't have it any more; I am going to stay with "my folks." I am willing to admit that I am not happy away from you. But you are not happy without my reputation, and so I must work to keep it up and increase it. . . .

I am in favor of going at our house immediately, and putting a house of some kind up, even if it be only a small one; or else of buying one outright. . . .

There is an important matter which may affect our coming out here next winter, and that is the absence of rain. If it should not rain next winter, it will be terrible for the state. Already they have no water at Oakland. . . . The usual supply has given out, and they have to dig wells and get a kind of salt water.

I feel better to-day.

Thine as ever, Jo.

There was by this time a new legislature; and a new Governor, Newton Booth, opposed to the survey.

TO WILLIAM DWIGHT WHITNEY

SAN FRANCISCO, *March* 9, 1872.

. . . Our survey bill has passed both Senate and Assembly by large majorities (36 to 2 in the Senate, and 54 to 11 in the Assembly). It is not thought that we are likely to be vetoed. The appropriation is $48,000 in all, or $2000 a month for two years. If we find that the Code is all right, we shall stand better than we ever before did, since the question was put fairly and squarely to the Senate, whether the survey should be wound up in two years, and decided No, by a vote of 35 to 3.

That "Code business" I could not make you understand without a long explanation. Suffice it to say, that an attempt was made to "choke me off" by means of an article syrupticiously — as Mrs. Partington would say — introduced into the new codification of the laws. Mr. Tompkins assures me that he has blocked that game; and now, if I can get through a bill authorizing the distribution of 250 copies of each volume, I am all right in spite of the Governor's opposition, which will not be able to do me any harm for the next two years certainly.

TO WILLIAM DWIGHT WHITNEY

San Francisco, *June 7, 1872.*

My dear Will, — . . . I had a very pleasant trip, through Owen's Valley, the scenery of which is stupendous! At Aurora my luck deserted me and we had five accidents in one night; but by none of them was I killed. The high water impeded all our movements, and made it necessary for me to change all my plans, and return to San Francisco; which was lucky, since it turns out that there is to be no money in the treasury this year, so that I am in a regular fix with a bill on the way from Bien of about $6000. . . .

I have decided to wind up the survey as soon as I can; that is, to close all the field work, spend the rest of the money in publication work, and to give up all idea of an indefinite continuance of the undertaking.

We propose to travel for a couple of years, and then to settle down in quiet, at Cambridge, or somewhere else.

My observations on the Owen's Valley earthquake, I am writing out for publication in the August number of the "Overland Monthly," if they prove interesting enough to make a readable article. Louisa and Eleanor have gone to the Big Trees.

TO WILLIAM DWIGHT WHITNEY

CAMBRIDGE, *October* 13, 1872.

. . . I had a very flattering letter from the Secretary of the Royal Geographical Society, saying that I had been nominated for Honorary Membership, and calling attention to the huge puffs of the survey in the President's annual addresses of this year and the last.

TO WILLIAM DWIGHT WHITNEY

CAMBRIDGE, *October* 28, 1872.

. . . Petermann gives the survey a tremendous puff in No. X of the "Mittheilungen" for the current year. In a lithographed circular, he informs me that he has immortalized the name of Whitney by sticking it into a cove of the island of Nova Zembla. Will divide with you, so that "honors shall be easy." Only let me have a small fraction of the glory painted around your head in the last "College Courant"! Seriously, I am glad that the survey is getting into notice. It helps me fight the Governor: and it is a desperate fight between us.

TO WILLIAM DWIGHT WHITNEY

SAN FRANCISCO, *June* 19, 1873.

MY DEAR W. D., — C. King has just been in and says that he has completed an examination of the Mine and finds that there is about $8000 worth of ore left in it. He made the examination on behalf of the Glasgow stockholders, who hold a large amount of the *highly valuable* stock! He confirms my statements, that the whole swindle was engineered by the same persons who put through the sale: A——, B——, C——, and D——. Comment is superfluous.

I did not expect, however, that my statements, made a year ago, would be so fully and so rapidly confirmed.

The names in the following letter are all those of assistants on the survey.

TO WILLIAM DWIGHT WHITNEY

CAMBRIDGE, *September* 25, 1873.

MY DEAR W. D., — Goodyear writes that some men have climbed Mt. Whitney on the southwest side, going first to the bogus one and then on to the genuine. Hunter, Rabe & Co. have not been heard from, but the men who made the ascent had Belshaw's aneroid with them, which stood 1000 feet higher on the real, than on the bogus summit. Belshaw's previous trigonometrical measurements gave 900 feet difference. If King's barometric result on the peaks he ascended be taken as correct, and 900 feet added, we have 14,612 + 900 =

15,512! Any way Mt. Whitney is pretty safe to be over 15,000.

The curious point is that the southwest is the side from which King professed to have attacked the mountain, and up which he could not go quite to the summit. The party which went up on that side, report the climb as hard, but not dangerous. It is probable now that Hunter and Rabe will get to the top, and they are provided with good barometers. Goodyear telegraphed for the elevation of Lone Pine, and that was since his letter was written. Hunter may have got to the top; or Goodyear, hearing that this other party had succeeded, may have thought it best to telegraph, so as to be in readiness to give the result from the sea-level.

Show this to Brewer.

So Mt. Whitney was conquered at last, nine years after King's first attempt. Its height turns out to be considerably less than the first measurements, and is 14,501 feet. Nevertheless, outside Alaska, it is the loftiest peak in the United States.

TO WILLIAM DWIGHT WHITNEY

San Francisco, *January* 27, 1874.

My dear Will, — . . . I feel Agassiz's death very much, for he was the warmest possible friend to me, and he never took offense at my friendship for Desor, nor at any of the saucy things I said in my lectures. The night before we left Cambridge, he spent the evening at our house, and when Nora kissed him as he went away, the tears came in his eyes, and in mine too, for I had little expectation of ever seeing him again. He looked like a doomed man.

Poor Mrs. —— too; she was one of the two R—— girls of whom Theodore Parker was so fond, and whom he called his little "bits of buds and mites of blossoms," when they lived together in West Roxbury.

Another legislature was now in session; and the new president of the State University, Daniel Coit Gilman, later of Johns Hopkins, made common cause with Whitney against a common foe.

TO WILLIAM DWIGHT WHITNEY

San Francisco, *February* 16, 1874.

My dear Will, — . . . The survey looks very bad. I have hardly a shadow of hope that anything will be done for good; and much fear that some preposterous legislation may be brought about. The legislature is terrible, and they are "raising Cain" with the railroads, the University, and everything else. Gilman is very much annoyed: but . . . he has a certain pride about going away from here, and perhaps a faint hope that he may worry the thing through. He has n't had thirteen years of worry as I have! . . .

TO WILLIAM DWIGHT WHITNEY

SAN FRANCISCO, *March* 3, 1874.

MY DEAR WILL,— . . . Gilman is engaged in a hard fight to save the University from the claws of the grangers who want to make a manual-labor school of it. Gilman feels very much discouraged, especially as he now realizes fully that a state institution must always be in hot water. For each legislature can undo the work of its predecessors, and they have full power to pull down and alter as they please. Already, by the New Code, all the Regents are appointed by the Governor, and by the constitution of the state, can hold office only for four years, so that politics and change must ever be the predominating elements in the concern.

The survey I look upon as defunct. The Governor [Booth] is "too many" for me. With state and federal patronage together, he controls the legislature easily. The feeling in general about the survey is good, but even my best friends are paralyzed by the Governor. It is much less of a trial to me to leave the survey than it would be if I did not know that there will be no more money in the treasury this year any way. I have offered to finish up a large amount of work with $60,000, having formally withdrawn my first offer to finish all for $100,000. The Committee are warmly in favor of accepting my proposition; but the Governor evidently holds them in check, and they hesitate to report, — waiting to see what will turn up, I suppose.

TO WILLIAM DWIGHT WHITNEY

SAN FRANCISCO, *March* 19, 1874.

MY DEAR WILL, — The survey has succumbed to the stupidity and malignity of the legislature, backed by the same characteristics on the part of the Governor. The Committee reported in favor of continuing the work, putting it under the supervision of a "Board of Survey," as you may see from a copy of the bill proposed. I would not have acted under this had it passed, and had the place been offered to me; but the discussion turned entirely on me and my work, without any hint of the possibility of the employment of any one else. I was accused of having given all the collections to Harvard; and it was stated over and over again, that the survey had been run by me for the benefit of Harvard University! The question now arises, what will be done with the materials? Possibly some bill will yet be got through taking them out of my hands entirely. I shall have to wait until the end of the session to ascertain what position I am in. At all events I am pretty nearly square with the state in my expenditures, so that my position is one of comparative financial ease; and, of course, I shall not, under any circumstances, involve myself as I did before, when the work was left in my hands, Haight being Governor, and giving me the weight of his authority so far as it went. Still I never should have got back a cent of that money, had it not been for Mr. Tompkins. And he is dead, and has left no successor. . . .

We propose to go to Europe in May or June, if nothing unexpected happens. How long we shall remain, I do not know; but the idea is to go on quite a tour, perhaps to India, or Australia, or both, and possibly back this way. Much depends on Louisa's health and how she stands the journey. My own feelings are decidedly those of relief at getting the survey off my hands, with no fault or *laches* of my own, for it is *hard work* making a creditable thing of it on a small amount of money. I have always got more curses than coppers out of it.

Yours ever,

Jo.

CHAPTER XI

THE RESULTS OF THE CALIFORNIA SURVEY

WHITNEY himself attributed the discontinuance of his survey to four causes: the general ignorance and indifference of the public concerning all scientific matters; the intrigues of various persons who foresaw advantage for themselves if the survey should be reorganized under another head; the hostility of a powerful group of speculators; and finally, rather perhaps an occasion than a cause, the personal enmity of Governor Booth.

The ignorance of the public was inevitable under the circumstances. There have been times when America has led the world in contempt for pure science, and California in the sixties and seventies by no means lagged behind her sister commonwealths. The survey had been from the first the project of a small group of enlightened persons, not the response to any popular demand. Moreover, the great mass of voters and legislators, when they acquiesced in the scheme for a geological survey, supposed that they were to get something after the fashion of the California State Mining Bureau, which was established later, in

1880. The survey, therefore, was in part stopped by men who, had they known what they were doing, would never have consented to let it start. Possibly, if Whitney had been a great teacher like Agassiz, he might have educated his public and kept his survey alive; but he could hardly have done it without sacrificing some other side of his work, and perhaps in the end would have lost more than he gained. Something of this, indeed, Whitney did attempt in his addresses to the legislature, and in print. Direct personal influence on individuals he left largely to his subordinates. For Whitney was never the man to employ language to conceal thought, while so far from suffering fools gladly, it was with some obvious effort that he suffered fools at all.

As for his relations with the Governor, the two men were predestined to dislike one another. Whitney complained of the Governor's "malignant hostility"; Booth in turn declared that by no other man had he ever been so insulted in all his life — as one may easily believe if Whitney's words in California matched his letters east. Nevertheless, Booth was a politician, who aspired to further honors, and indeed, a year after the close of the survey, resigned his office to become United States Senator. He would hardly have risked a trial of strength if he had not been pretty sure in advance that he had the public on his side.

No small part of this general hostility Whitney believed to be purely factitious, the work of a few speculators, who, when they found in the survey an obstacle to their schemes, found also in the less scrupulous of the Californian newspapers a ready tool to employ against it. The survey did not trespass on the field of the mining engineer, but the first report of 1864 set forth with a good deal of detail both the regions within which metals and oil might be expected to occur, and the facts with regard to their actual presence. Moreover, it was Whitney's policy from the beginning, to put all data in possession of the survey at the command of any citizen who cared to apply, to answer in person or by letter all requests for information, and to have his assistants give without fee any special aid which did not interfere with their more immediate duties. Under these circumstances, the opportunity for fraudulent dealing became inconveniently restricted.

The attempt was made during the later years of the survey, and has been made since, to discredit Whitney's judgment on the ground that he denied the occurrence of petroleum in California, though California has of late years become the fourth oil-producing state in the Union. As a matter of fact, Whitney did nothing of the kind, as one may easily discover by consulting the report of 1864. On the contrary, he investigated every reported discovery of oil lands. In several instances he employed special experts in addition to his regular staff, and he advised the legislature to spend a reasonable sum in experimenting with the commercial possibilities of California oil. What he did do was to point out that the actual state of affairs on the property of certain companies did not at all bear out the statements of their prospectuses; that the geological conditions in California are essentially different from those in Pennsylvania; and that the eastern chemists to whom he had referred the problem, reported that in the existing state of chemical science the California oil could not be made to yield an illuminant on a commercial basis. Moreover, there is no longer any doubt that Whitney was right when he averred that certain auspicious reports of other eastern chemists had been obtained by the simple device of sending them specimens of Pennsylvania oil.

It must be borne in mind that in the early days of petroleum, the valuable constituent was the kerosene; for by the middle fifties the supply of whale oil had practically come to an end, and the public, in the absence of gas, had to choose between candles and "camphene." The wisest of state geologists could hardly be expected to anticipate asphalt paving, the oiling of roadbeds, and the gasolene engine; or to forecast battleships driven by crude oil, in a day when locomotives were burning wood. The essential point of Whitney's contention was that Californian kerosene would not compete with Pennsylvanian—and it never has. As late as 1904, when California was producing more than fifteen million barrels of crude oil, it was not even supplying its own market for kerosene, for an oil that will burn under a boiler is not necessarily an oil that will burn in a lamp. It may be that Whitney reiterated various unpalatable truths with unnecessary emphasis. Nevertheless, the companies whose claims he controverted did fail; it was not until after 1892 that the oil industry of Ventura County began to attain to anything beyond local importance; and the petroleum of California, so far from flowing on the surface in rivers, has come from deep wells driven under peculiar difficulties. Such are the facts; facts which it has been easy for interested persons to distort beyond recognition.

It will probably strike most people that when the State Geologist, in a period of unbridled speculation, advised caution and a due consideration of practical difficulties, he did no more than his duty. The way it struck his fellow-citizens in California may be guessed from the fact that, when one of the San Francisco newspapers exposed a piece of unalloyed rascality on the part of a group of promoters, the outraged public arose in its indignation—and wrecked the newspaper. In a very real sense, therefore, Whitney sacrificed the survey to a standard of conduct that had gone somewhat out of fashion in the years which followed the War.

It must not be forgotten that the period of Whitney's work in California was also the period of the Crédit Mobilier and the Tweed Ring, a period when college presidents and clergymen lent their names to unsound business enterprises, and the religious press, with all its differences in matters of doctrine, was a unit in accepting any advertisement that offered itself. In a man like Whitney, sprung from a race of honest merchants, such a condition of affairs aroused a burning indignation that was no respecter of persons. He himself, during thirty years' connection with mining surveys, never owned a single dollar's worth of mining property; he wrote "The Metallic Wealth of the United States," in no small part, for the sake of protecting the inexpert investor; and shortly after he left California, he and his brother William withdrew from the National Academy of Science because it would not maintain what they regarded as a proper standard of professional honor among its members. These things he did at a period when his scruples were looked upon less as counsels of perfection than as signs of mental aberration. Whitney has been called "an easy man to quarrel with": his bitterest quarrel had at least the justification of a good cause; and he did his part toward bringing about the era of comparative decency which followed Grant's second term.

Worth quoting here, as comment on this aspect of the situation, is a letter which Agassiz wrote to an influential Californian, during Whitney's controversy with the oil speculators.

LOUIS AGASSIZ TO G. B. BLAKE

CAMBRIDGE, *December* 6, 1866.

DEAR SIR,— In answer to your question concerning Professor Whitney, I would say that my personal knowledge of Mr. Whitney's scientific attainments goes back for nearly 20 years. When the Geological Survey of California was organized, I proposed him for that position, because I was satisfied that he was the ablest man in the country to fill it, and, of all the geologists I knew, one of the few who would not speculate upon his scientific information, but honorably report what he knew to be true. I have never had occasion to change my opinion upon those two points, which cover your whole inquiry. Allow me to add that the published reports relating to the Geology of California emanating from his pen, have only increased his scientific standing, and his opposition to mining schemes intended as speculations shows that his character has not been lowered by the great temptations which have surrounded him for years.

Very respectfully yours,
L. Agassiz.

These then are the chief causes for the failure of the California Survey. There remain in addition certain minor elements which, though no one was in itself especially important, probably had altogether a good deal of weight. For one thing, it was unfortunate that the State Geologist thought himself compelled to spend so much of his time at the East. Good friends of the survey felt that even if the printing could not be done in California, Whitney might have imported engravers, remained on the ground, and handled his reports instead of his field work at arm's length. Moreover, there was a persistent rumor that the collections of the survey were being given to Harvard College; while, at the same time, Whitney never quite succeeded in making the public understand that although he had been in the employ both of Harvard and California, he had never taken pay from both at the same time. Doubtless, too, a change in the order of publication, to put the economic volume early and the two on paleontology later, would have helped. Oddly enough, the appearance of the "Origin of Species" in 1859 hurt the survey. To the general position of Darwin, Whitney was an early convert, but his thoroughly scientific habit of mind as little inclined him to follow Haeckel on the one hand as Agassiz on the other. Like his old master Lyell, he believed that the first task was to help the new doctrine to a hearing on its merits. For this reason, in his address to the legislature early in 1862, he went somewhat out of his way to set forth the ideas of the "Origin." Nothing could have been more moderate in tone. Whitney dwelt upon Darwin's high repute in the scientific world, assumed that the matter was one in which an intelligent legislature would naturally take an interest, but committed himself only to the opinion that "the discussion of this interesting subject . . . will be of essential service to the progress of science."

Whitney promptly discovered that this by no means radical conviction was very far from being shared by the California clergy. The life of the survey coincided almost precisely with the controversy over Evolution, a controversy whose bitterness we of these easy-going days find it hard to realize. Inevitably, therefore, the church-going portion of the community became still farther exacerbated against the survey, when after the discovery of the Calaveras skull in 1866, Whitney became the foremost American advocate of Tertiary man.

Evidently, then, the termination of the California Survey was due less to any single cause than to a variety of independent factors which varied in importance from the floods of 1862 to the persistent refusal of the State Geologist, in a community essentially Southern in customs, to drink whiskey in a saloon between meals. Yet although the scientific world is in general agreed that the last State Geologist of California was hardly used, there remains, nevertheless, not a little that can be justly urged from the side of legislature, Governor, and public. The survey cost, all told, a little less than $350,000; and $25,000 a year seems a small sum compared with Hayden's $95,000 for the Survey of the Territories, or the $200,000 and more of the United States Coast Survey. Still, Hayden in 1867 and 1868 laid the foundations of his survey on $5000 a year, and carried through his reconnoissance of the Upper Missouri, dependent for sustenance on the hospitality of acquaintances and on what he could earn by the way. California, in 1860 when the survey began, looked to a future of unlimited growth and prosperity, and cut its coat according to the cloth it expected to own. Its actual lot was flood and drought, the competition of other gold fields, and the Civil War. Under these changed conditions, there were many well-intentioned persons who felt that elaborate, hand-colored monographs on birds and land shells were not the things which the young state needed most. As it turned out, the California Survey, on the scale on which Whitney planned it, was distinctly premature.

How large this scale was, one appreciates only by comparing the California Survey with the other state surveys which went before it. If Whitney could have carried his work through to the end which it nearly reached, it would have cost in all some $450,000 and taken fifteen years. Jackson's survey of New Hampshire, which gave Whitney his first training as a geological surveyor, required three years and cost each year $3000. The Lake Superior Survey lasted four years. The original surveys of New York and Pennsylvania, which between them made the reputations of a half-dozen geologists, each consumed a half decade. Even as late as 1866, Swallow's survey of Kansas occupied only a year and a half; while at about the same time the legislature of Nevada tried, vainly to be sure, to find a reputable geologist who would undertake the survey of the state at a total cost of $6000, and finish his task in eight months. By however much, therefore, California fell short of her State Geologist's ideals, she surpassed in at least an equal measure anything that her sister states had done.

Yet granting that the survey was more than the state could reasonably afford, Governor Booth chose an especially unfortunate time for bringing it to a close. Another year and a half would have carried the work to a convenient stopping place; and in fact, Whitney had decided finally that if the survey went on after June of 1875, it should be in other hands than his. But when he was "thus unceremoniously ejected from the State of California, with no other right or privilege left than that of paying the debts of the survey out of his own pocket," he not only had to leave matters hanging in the air, but, in addition, to sacrifice a considerable amount of important material that was nearly ready for publication.

All this material, by act of the legislature, passed into the control of the Regents of the State University, a body, as a whole, thoroughly hostile to the State Geologist and the survey. The Regents, however, could make no use of it, and Whitney had a stanch friend at court in the Secretary of the Board, Dr. Robert E. C. Stearns. In time, therefore, and in one way and another, much of this data came back into Whitney's control.

A private subscription of $5000, engineered by Judge S. C. Hastings of San Francisco and helped on by Gilman, Leland Stanford, and D. O. Mills, enabled Brewer, with Whitney's help, to bring out his Botany, though at a cost to himself of two years' unpaid labor, $2000 out of his pocket, and the accompanying loss of his salary at Yale. There were printed also three volumes on birds, largely at the expense of Alexander Agassiz. In both cases, the dozen or more specialists who had a hand in the books, did their parts at considerable sacrifice, Baird, for example, advancing a thousand dollars on his portion of the "Birds." The geological material was absorbed by various scientific journals, especially by the publications of the Museum of Comparative Zoölogy at Cambridge. So far as anything that the State of California did, at least half of the labor of the survey would have gone for nothing.

Fortunately, the more important topographical maps were nearly all ready for printing before the end of 1873; and since these met with a ready sale, they practically took care of themselves. There was still wanting, however, a few months of field work to complete one of the four sheets of the large scale map of Central California; and only three of the sheets ever appeared. Two more sheets also of this map were under way, and the six together would have included all the inhabited portions of the state. These were a total loss.

The geological maps, less advanced than the topographical, were still less fortunate. The "Bay Map," which borrowed its triangulation from the charts of the Coast Survey, was farthest along and was preserved. The rest of the geological maps, the printing of some of the sheets actually begun, waited vainly year after year, and were then, to quote their author, "ground off the stones together with $5000 of my money."

All this was most unfortunate for the reputation of the California Survey. Any such piece of scientific work is likely, in the long run, to be judged by its printed documents. A shelf full of well-printed reports, appearing promptly on the completion of the work, makes far more impression on the scientific world than does the same material, however valuable, when strung along over a decade and scattered through the publications of half a dozen learned societies and as many popular magazines. The investigator, intent on a single aspect of a multifarious work, needs continually to be reminded of the portions which he does not use.

The California Survey, moreover, coming as it does between the era of the state surveys and the beginnings of the United States Geological Survey, has been in a sense devoured by its own offspring. It inspired, to a degree which has seldom been adequately recognized, the most important piece of scientific work that has been done in America, and the best piece of geological surveying that has been done anywhere. The traditions of the Government surveys go back only to Clarence King, Hayden, Gardner, Wilson, Emmons, and Gannett. Back of them, however, stands the half-forgotten California Survey which first worked out the problem of handling great stretches of wild country, and trained up a group of geologists and topographers, without whom the United States surveys could hardly have been what they were. Furthermore, one of the early tasks of the United States Geological Survey was to continue Whitney's unfinished work. Inevitably, to the builder of the superstructures is attributed the foundation also.

That the Government surveyors themselves recognized their debt, appears in a letter which Gardner, then Chief Topographer of the Survey of the Fortieth Parallel, wrote to Whitney from Washington in May of 1874, just after the close of the California Survey.

"You must know without my saying it how much I regret the action of the California legislature. I think it one of the severest blows that science has received in this country. We shall feel it very much in our own work, as there is so much that you were about to publish which would throw light on our problems. Few will feel it as we who are laboring in adjoining parts of the Cordillera system.

"The thought that the seeds which you planted in us young men are bearing fruit while you are cut off from your harvest, is very painful to me. For I feel that to your illuminating and fostering influence is due the starting of improved topographical work in this country. I acknowledge with pleasure and gratitude that I received from you first those ideas of what topography might acomplish for geology which I have ever since been endeavoring to systematize, develop, and put into practical execution over large areas.

"I wish you would come on and visit me, and see the last fruit that your little plant has borne. It is the best thing that I have done yet. . . . We have lots of plunder here in the way of photographs and publications, and you better load up before going to Europe. But better than all plunder will it be for your fatherly eyes to see the licking that we are going to give those arrogant and grasping [army] engineers."

The significance of this letter of Gardner's becomes more clear if we review briefly certain points in the history of modern cartography.

When Whitney commenced work in California, three government boards at Washington were issuing three different kinds of maps. These were the charts of the United States Coast Survey, the areal maps of the General Land Office for the distribution of the public lands, and the maps based on the linear surveys of various government exploring expeditions. The Coast Survey maps were made by elaborate triangulation, which sometimes involved a whole season's work at a single station; they were accurate to a few inches in a hundred miles—and were correspondingly expensive.

The public lands were mapped by an ordinary chain and compass survey, at the hands of all sorts of unskilled and casual surveyors. They answered their purpose adequately enough, so long as transfers of property were based upon the boundary stone and other actual monuments of the first survey, and no attempt was made to repeat any determination. This method has the merit of cheapness; its obvious limitations are that it takes no account of topography, and that it is impossible except in a flat country. The linear surveys of the army were worst of all. These started from a base more or less accurately located, twisted and turned with the progress of the expedition, and the farther they progressed, the more confused they became. Whitney, in California, found these army maps absolutely unusable. Observations of longitude were not uncommonly two miles out of the way; even mountain ridges could not be identified, because the error in locating any one was greater than the distance to the next. It was accounted a great victory for science when in 1874 the civilian geographers at last succeeded in getting the Government map-making out of the hands of the army; a victory, moreover, in which the former Californians did most of the fighting and Whitney himself had no small part.

Obviously, California could never afford maps triangulated on signal stations after the manner of the Coast Survey. Neither, on the other hand, could a country, so largely mountainous, be mapped by the ordinary methods of a land survey. And yet it was Whitney's doctrine, an idea which he as much as any one man brought into universal practice in this country, that there can be no proper geological work that is not based on accurate topography. In this dilemma, Whitney fell back on a method with which he had experimented somewhat in his Lake Superior days. He used no special signal stations; but with an ordinary surveyor's transit he triangulated on the sharp mountain peaks. Then, from convenient elevations, he mapped in the intervening country by the eye.

The device sounds crude enough. It has turned out in practice to be so much more precise than any other method which can be applied at anything like the cost, that for ordinary topographical work over considerable areas, it has now superseded all other systems throughout the civilized world. It is several times more rapid than a less accurate survey with chain, staff, and level. For small scale maps it is a hundred times less expensive than a geodetic survey that is often practically no better.

This general plan, then, was Whitney's. He was lucky enough to find in Hoffmann a thoroughly trained draughtsman and surveyor, capable of working out its practical details. The map which accompanied the "Yosemite Guidebook" was the first triangulated map, and therefore the first decently accurate topographical map of a rough country ever printed in the Western Hemisphere.

Hoffmann, after 1864, taught the new method to the topographers of the California Survey. When King took charge of the Fortieth Parallel Survey, in 1867, he made Gardner his chief topographer, and took also from the California Survey Wilson and Emmons.

In the meantime, Hayden, on the United States Survey of the Territories, was doing no topographical work at all. To the remonstrance of Whitney, who met him in 1869, he replied that he simply could not find men to do the work. As soon, however, as King's survey came to an end, Hayden took on Gardner and Wilson, and thereafter mapped after Whitney's method. Powell did little topographical mapping on his earliest surveys. Lieutenant Wheeler clung to the obsolete methods of the army.

King became the first head of the United States Geological Survey in 1879, and at once absorbed all the available topographers of Hayden's and Whitney's surveys, and the men whom they had trained in their turn. Of these, Emmons has been connected with the United States Geological Survey ever since; and Gannett, who, before he went on Hayden's survey, was one of the four students from the Harvard Mining School whom Hoffmann taught surveying in the Colorado mountains, has had his name on the border of some hundreds of thousands of sheets of the great topographical map of the United States which has been under way for a generation and is not yet half done.

Since Whitney's time the plane table has come into more general use, so that the topographer depends less on his "eye for country" than he once did. The United States Geological Survey, having more money to spend than the California Survey ever dreamed of, can afford to employ in its primary triangulation some of the expensive devices of the Coast Survey; moreover, it has educated the public to the familiar atlas sheet and, to some extent, to the contour line in place of the older hachure which Whitney used. Aside, nevertheless, from such minor improvements, Gannett has been mapping the United States by the method which he learned from Hoffmann in 1869.

In a sense, of course, all these happenings were inevitable. Any one of a dozen men confronted with Whitney's problem would have hit upon his solution of it. Still, it did happen to be Whitney, and not somebody else, who impressed a group of able disciples with certain ideas and standards and methods just at the particular time when the world was ready for them. In the same way, in 1863, Whitney happened to be experimenting with photography in a waterless country when the first dry plates were coming on the market, and thus was the first to employ systematically this important adjunct to a modern geological survey. For the most part, the scientific world knows American geological surveying through the publications of the Government; the present generation of geologists and topographers has come up since the beginnings of the United States surveys, and knows little of its scientific ancestry. Nevertheless, the California Survey first shook the tree of which the United States Geological Survey has gathered up most of the fruit.

CHAPTER XII

THE STURGIS-HOOPER PROFESSORSHIP.

1874–1879

AFTER fourteen years of California, Whitney had fairly earned a vacation, while his wife, always insatiate for new experiences, had long set her heart on a year of travel. The family sailed for Germany early in June of 1874; and while the daughter remained with German friends in Hanover, Whitney himself visited scientific acquaintances, and attended scientific meetings. The chief attraction was an important congress at Stockholm. After that, the plan was to travel east as the spirit moved and Mrs. Whitney's health permitted, to visit Australia, and come home around the world.

TO WILLIAM DWIGHT WHITNEY

DRESDEN, *July* 15, 1874.

DEAR W. D., — . . . In Berlin we did all the usual sights, and I was greatly attracted by the Egyptian collection. I saw Weber [the great Sanskrit scholar] a few minutes; his wife and family were "gone to the Bad" — where all the Germans go. . . . I went with Richthofen to meetings of the Geological and Geographical

Societies, and heard some of the African travelers hold forth — *namentlich* Rohlfs and Schweinfurth. Had a ticket to the Leibnitz anniversary of the Academy, but found it too hot and crowded, and so gave it up.

Richthofen has secured the publication of his work by the Prussian Government. It will comprise four quarto volumes and an atlas of 40–50 maps. His work effects a complete revolution in the topography of China. Newberry's and Pumpelly's discovery of the Triassic age of the coal is all set to 0. R. found fossils in the greatest abundance and especially Silurian and Carboniferous. It is strange that Pumpelly missed them so entirely.

We go to Tharandt to-morrow and thence to Freiberg and into Thuringia, to some quiet spot where we will spend a week; then to Berlin, Copenhagen, where we meet Desor, and Stockholm by the first of August, if nothing unexpected happens. In Dresden we have done the big sights and some of the side shows . . . seen a lot of Californians . . . and various and sundry others. I do not find Germany so very much changed — prices are higher, and highest of all here, but still even here not extortionate. . . . In one respect I notice a marked change and that is the disappearance of the French language. We hardly hear a word of French spoken; while I remember distinctly thirty (!) years ago, that French was much spoken at the hotels. I do not find many Germans who speak English fluently; the universal knowledge of that language said to prevail here is "nicht vorhanden." . . .

Since leaving home I have heard very little of what is going on. . . . The new edition of the "Guidebook" is out and so is the "Barometric Hypsometry." . . . I am fat and lazy — so lazy that I feel only fit to be put in a pig show!

TO WILLIAM DWIGHT WHITNEY

NEUFCHÂTEL, *August 22, 1874.*

MY DEAR WILL,— We have had hard times in our family for the last month, for Louisa has been very sick; and in fact, I thought it very doubtful if she would get back home again. We went to Hamburg partly because it was on the way to Stockholm, and partly because it was a good point from which to start for home, in case of necessity. Just when the case looked darkest, and we had telegraphed to Nora to come to Hamburg, Louisa's disease took a favorable turn, and ever since she has been improving, although at a rate which could only be measured by a micrometer screw. She lives entirely on oatmeal gruel and bouillon,— the only things for sick folks that we have been able to scare up in this country. We have spent the last ten days at Glion, 1500 feet or so above Lake Geneva, a place unrivaled in beauty of scenery and healthiness of atmosphere. On arriving here, we met Desor, who had just returned from Stockholm, and who has changed very little in appearance from what he was when we were together on Lake Superior — now twenty-four years ago! We go up to his Châlet in the Jura to-morrow to spend a few days, if it suits Louisa's health.

TO PROFESSOR JEFFRIES WYMAN

NEUFCHÂTEL, *August* 22, 1874.

MY DEAR DR. WYMAN, — Circumstances made it impossible for me to go to Stockholm after all, for which I was very sorry. My wife was taken seriously ill, and we could get no farther than Hamburg; and when she was able to travel, it was too late for the meeting. . . .

Desor gives most glowing accounts of the meeting, and is highly impressed with the good work the Swedes are doing in science — their painstaking accuracy *without brag*. He seems to have lost confidence in the French, and has not been to Paris since the war.

I feel now more inclined to publish my California results (in regard to prehistoric man) in a special volume, with a full account of the geology connected with the work; for without a full setting forth of the geological structure of the country, it will be impossible for any one to appreciate the character of the evidence . . . from the anthropological point of view. At all events, it is well that I did not bring these matters up at Stockholm; for in the crowd (of 1400 persons) and the pressure of business, the most that I could have got was an hour, and that would n't answer the purpose for laying the facts before the public in such a way that they could be comprehended and believed in. . . .

So in the end, because of Mrs. Whitney's illness, the plans for travel round the world came to naught, and the middle of November saw the Whitneys back at 12 Oxford Street.

The many-sided activity of the California days continued throughout Whitney's professorship at Harvard. His old ally, Gilman, consulted him with regard to the development of Johns Hopkins; Boyd Dawkins besought his advice for Owens College at Manchester. He drafted the petition to Congress, in which the learned men of the United States asked the removal of the tariff on books; he had a hand in preparing the bill for reorganizing the management of the Yosemite grant. He wrote popular accounts of his own work for the "North American Review," and reviews of other men's books for the "Nation"; and he went down to New Haven and lectured to the Scientific School on the Egyptian pyramids.

The academic duties of the years which followed proved to be of the most congenial sort. The short-lived Mining School of which Whitney had been the head was merged, in 1875, with the Lawrence Scientific School; there was, in consequence, a short period of uncertainty as to Whitney's status, and then, on April 14, 1875, he was reappointed to his old chair, the Sturgis-Hooper Professorship of Geology, which had been founded ten years before for the special purpose of keeping him in the East. A month later he entered the Faculty of the Museum of Comparative Zoölogy, in the place left vacant by Oliver Wendell Holmes. Both positions he retained until his death.

The Sturgis-Hooper Professorship is among the best endowed chairs in the University; and its occupant is, by the terms of the foundation, absolved from that particular bane of college work in America, the routine instruction of beginners. It still remains one of the few professorships in this country after the German plan — the feast for the great scholar, for the undergraduate the incidental crumb. Freed thus from the drudgery of administrative duties and of elementary teaching, and largely cut off by his wife's ill health from social life, Whitney spent himself without stint on the professional training of mature men, on his private studies, and on the salvage of the California Survey. His lectures were carefully prepared, were generally delivered from note-book outlines, and were abundantly illustrated from his extensive library. He took pride in placing the best books and maps before his classes, although he sometimes had occasion to lament heedless injury to his choice possessions.

At no other American institution could Whitney have been either so contented or so useful as at Harvard. He was untrammeled either by trustee or young person; he was encouraged to apply the methods and standards under which he had himself been trained. "Here," he affirmed, "I could and did lecture as freely as I could have done in Germany." On the other hand, only the Agassiz Museum, with its ample funds for publication and its superb opportunity for work, could utilize to the full a man with so few special gifts as a teacher.

For Whitney, in spite of unusual skill in setting forth ideas in print, had but moderate success as an instructor. His somewhat thin and high-pitched voice was ill suited to large audiences; and he had, besides, the misfortune to come to his teaching so late in life that he had forgotten his own student days, and never quite understood the workings of the adolescent mind. His popular lectures, open to the general public as well as to members of the University, were successful, but not conspicuously so. A popular reputation is apt to be conditioned on the absence of certain qualities that are highly essential to a man of science.

Doubtless, in the course of time, Whitney would have attained in the teaching art to the standard, by no means exacting, of the average college instructor, if it had not been for the peculiar organization of his department. He belonged rather to the Museum than to the College; and it is the policy of the Museum to subordinate teaching to research. Only by his own choice does the Sturgis-Hooper Professor of Geology do any teaching at all. Moreover, the department had in Nathaniel Southgate Shaler a man of extraordinary gifts for interesting and inspiring boys. Naturally, then, the organization of the department and the elementary instruction within it, fell to Shaler and his subordinates. Only after a student had become pretty well advanced in his subject, and had pretty definitely committed himself to a scientific career, did he come under Whitney.

Whitney usually offered one or two courses of lectures, amounting altogether to no more than three or four hours a week; and portions of even this small amount he sometimes turned over to an assistant. He did almost no field work either with his pupils or privately. He had no laboratory, and seldom so much as exhibited a specimen to his pupils. His classes were small, usually no more than a dozen or twenty; and he rarely gave any instruction outside his formal lectures. He had, therefore, no special group of disciples to disseminate his opinions or assist him in his private work.

Nevertheless, Whitney's influence on geologic progress in America has been very considerable. His students were few, but they were picked men. Lane of the Michigan Survey was his pupil, and Landes of the Washington Survey. He gave to the United States Geological Survey Gannett, Marvine, Brooks, Diller, Keith, Schrader, and Spurr; and to the educational institutions of the country, Davis, Wolff, Jackson, Eastman, Daly, Jagger, Collie, Dodge, Tarr, Cobb, Westgate, Ladd, Foerste. He trained, therefore, not only a considerable body of working geologists and mining engineers, but that whole group of teachers who have of late years been revolutionizing geographical instruction in America from the universities down to the primary schools.

Whitney's work at Harvard, then, was by no means unlike his work in California. He did his routine teaching as he did his routine surveying. In addition, at Harvard as in California, he set a standard for other men to follow. He was fundamentally a critic and a productive scholar. He took men already well trained, to whom his encyclopedic knowledge was at once a revelation and a challenge, and he showed them mercilessly their limitations and their faults. They went to him to be taught economic geology, and they learned accuracy, caution, the wealth of information already in print, and the admixture of confusion which accompanies it. While he placed his books at their service and taught them the sources of knowledge, he taught them also the sources of error. Whitney was not a popular teacher, nor even an inspiring one. He was an accurate and painstaking scholar, who set for his pupils an ideal of scholarship, and taught them not to make mistakes.

FROM THOMAS S. BAYNES, EDITOR OF THE "ENCYCLOPÆDIA BRITANNICA"

EDINBURGH, *May 24, 1875.*

DEAR SIR, — Your brother, Dr. Whitney (whom I had the pleasure of welcoming here lately), tells me that you are willing to give us your valuable help in the American department of the new edition of the "Encyclopædia Britannica."

The first heading of importance in advance is *California*. I am most anxious to have a good article on this subject and hope you will be able to undertake it. The country has advanced so rapidly since the publication of the last edition that the old article will require to be largely added to, and perhaps altogether rewritten. You will be the best judge as to this. . . .

The new article might, I think, extend to nearly double the length of the old — say ten to twelve pages. With regard to time, I should be glad to have it as soon as you can conveniently prepare the pages — within the next three or four months if possible.

I may add that the rate of payment for original articles is two guineas a page. . . .

TO WILLIAM DWIGHT WHITNEY

CAMBRIDGE, *July* 15, 1875.

MY DEAR W. D. W., — Louisa is no better, and she feels pretty blue. She is at Prout's Neck now, . . . and I am cleaning house and getting things in order generally; also writing an article on Geological Surveys for the October number of the "North American Review."

This, with the one in the July number on Geographical Surveys, will make a libellum, which I hope will be of value to some. I am just taking possession of quarters in the Museum building, and hesitating about buying a lot of land adjacent, on which to build a house. The uncertain condition of Louisa's health takes away all my force, and keeps me depressed and anxious.

Hayden was here the other day, and Gabb has just gone away, having brought many interesting things from Central America for me to see. Among other things, he has worked up several of the Indian languages there with a great deal of care and skill.

. . . You have heard, I suppose, of the very sudden death of Winlock, to whom I was much attached. His illness, for which the doctors could find no name, lasted only six or eight hours. He never knew that his end was near. He just stopped work, and laid down and died, having exhausted his resources in the way of vitality. His poor wife found herself, instantly, not only robbed of a husband whom she adored, but with six children on her hands. . . . A house has been bought for her, not far from North Avenue, and she will soon leave the place where the poor Apothecary had done so much and bragged so little. . . .

TO WILLIAM DWIGHT WHITNEY

CAMBRIDGE, *October* 20, 1875.

MY DEAR W. D. W., — . . . In a few days, I will send you and Brewer copies of a little work entitled "California — Multum in Parvo." It is my "Encyclopædia Britannica" article on that subject, which the editor had set up and printed here to secure copyright. They allowed me to have twelve copies; of course not to be made public in any way. I flatter myself that it has got about as much reliable information crammed into it as could well be packed into the allotted space.

Later, Whitney brought together all his "Britannica" articles into a two-volume work entitled "The United States: Facts and Figures illustrating the Physical Geography of the Country and its Natural Resources." First, however, he made a beginning with the materials left over from the California Survey, — two volumes of the Botany, one of the Economic Geology, and a work in two parts on the Auriferous Gravels. It was not, however, until September of 1877, after a month in California, that Whitney obtained permission to use these materials "without expense to the State."

The work on Tertiary gravels led naturally to a study of Preglacial and of Glacial climate; and this in turn not only became one of the chief interests of Whitney's Cambridge days, but in addition resulted in one of his most important contributions to geological theory. "The Auriferous Gravels" had for its sequel "The Climatic Changes of Later Geologic Time." In this Whitney maintained, contrary to the prevailing opinion among extreme glacialists, that the Great Ice Age was a time neither of high elevation of land surface nor of especial cold. He opposed the theory of a single continental ice sheet, emphasized the importance of local glaciers, and explained Preglacial climate, the Ice Age, and the present desiccation of the interior of the larger continents as stages in a continuous process. The question is still one of the unsolved problems of science. The most that one can say is that general opinion is now considerably nearer to Whitney's position than it was when he wrote.

TO WILLIAM DWIGHT WHITNEY

CAMBRIDGE, *March* 24, 1876.

MY DEAR WILLIAM, — . . . I have been remiss in writing; but I have had little that was agreeable to say on any subject. The disgusting revelations at Washington . . . are enough to make one sad down to the very bottom of his boots — if one's soul extends so far. And Louisa's state of health takes away all my elasticity. I feel it as a weight ever bearing me down. She has days when she is, comparatively, so comfortable that she keeps on the appearance of being somewhat as others; but she is never free from pain, and often it is a great deal more than she can bear. . . . I have not been away from the house over night since Thanksgiving, but would go to New York now, if I did not feel unwilling to leave home unless it were absolutely necessary.

. . . I have read with interest all that has come to my hands, in regard to the Müller controversy. You certainly have come out "all right," in every respect. But the English will uphold him "quand même." There is no helping that! His notice of the [W. D. W.'s German] dictionary I felt to be Jesuitical in the highest degree. The answer in the "Jenaer Literatur Zeitung" I wish I could see, but they do not take that periodical in our benighted library. Van Name's article is excellent, bringing out some points more clearly than they have been before, and "rubbing it" in, so to speak. . . .

My course of lectures closes next week. After that, I shall take hold of the Geology (Auriferous Gravels) in earnest. The plates are just finished and are quite satisfactorily done. Whether the volume will be published uniform with the rest of the series, or as one of the series of the Memoirs of the Museum of Comparative Zoölogy, I have not yet positively decided.

I have given three dozen lectures on economical geology, which have cost me a large amount of labor to prepare, having been illustrated with innumerable diagrams on the blackboard and otherwise. Now, I could give such lectures again with comparatively little trouble. I needed the practice in lecturing, and rather like it, but it takes a fearful amount of time. I have worked a good deal on the subject of vein phenomena, with a view to the publication of a work on that subject. It is one which has always had a special interest for me.

TO WILLIAM DWIGHT WHITNEY

CAMBRIDGE, *June* 23, 1876.

MY DEAR W. D., — Corporation wants to give you the degree of LL. D. this Commencement, and Mr. Eliot desires that you should be present to receive it. Can you? Will you? If not, why not? I won't say anything about how much it would gratify me and Goodwin and Child to have you here. But if you won't come, tell me what I must tell Mr. Eliot. Do think about it and not refuse unless for some particularly good reason.

If you don't come, I shall tie my head up in my gown and sit in the cellar. . . . Of course nothing is to be said about the LL.D. matter.

. . . "Botany of California," Vol. I, the first of the *posthumous* volumes of the survey, is now ready.

TO WILLIAM DWIGHT WHITNEY

CAMBRIDGE, *July* 18, 1876.

MY DEAR W. D. W., — Moved by this *verflucht wetter*, I have written an article for the "[American] Naturalist" entitled "Are We Drying up?" and have another in hand on a cognate subject. . . . Is n't the heat atrocious? . . . Cambridge is quite deserted. . . .

. . . I have just heard of Ehrenberg's death. He and old Heinrich Rose were two of the best men God ever made!

P—— would n't come to see me — because I criticised his North American map, I suppose. He has never written me since that. He is about the most unpopular man in Germany.

TO WILLIAM DWIGHT WHITNEY

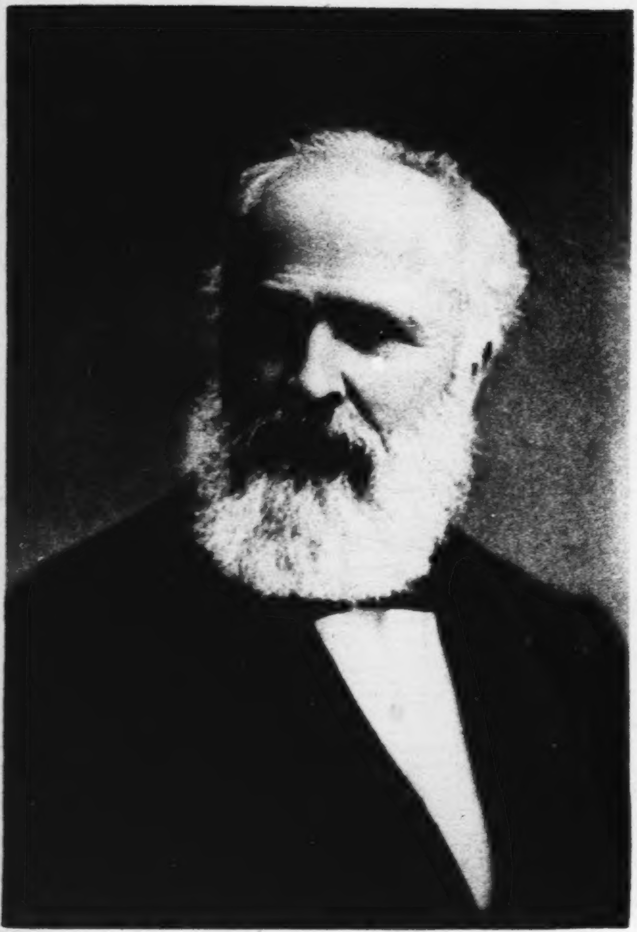
CAMBRIDGE, *September* 11, 1876.

MY DEAR WILLIAM, — . . . My own summer's work has been nearly nil. Physically I am strong and well, but mentally a failure. So much anxiety about Louisa has quite upset me. I wrote two or three articles for the "Naturalist," in which publication I have a small pecuniary interest. One, I send you; another one, much longer, which will follow in the October and November numbers, will, I hope, interest you. It is on the prairies. My plans for publication of the survey matters have, after much pondering, taken pretty nearly their final shape. One volume—uniform with the survey volumes—I propose to push ahead at once. It will be as much economical in its character as possible. Another one, on the auriferous gravel deposits of the Pacific slopes, will appear in the Museum publications, quarto form. One hundred fifty pages of the economical volumes are in type, and the lithographing of the illustrations for the other volume is nearly done. I shall have an elective this winter in economical geology, and also give a course of popular (University) lectures on the physical geography of North America.

TO WILLIAM DWIGHT WHITNEY

CAMBRIDGE, *January* 14, 1877.

MY DEAR W. D. W.,— . . . I have begun taking lessons in Russian of an individual named Panin. . . . Am curious to see if I have



grown too old to learn anything! August Fries [a son of the celebrated violinist] asked me, yesterday, if I did n't want to take lessons on the violin!! He comes out now and fiddles to Nora's accompaniment, once a week.

TO WILLIAM DWIGHT WHITNEY

CAMBRIDGE, *April* 23, 1877.

MY DEAR W. D., — . . . You ask what I have been doing this winter. Chiefly *learning to lecture*. I have given two courses extending through the whole year, speaking without notes almost entirely, and trying to get the habit of it. It seemed to me that if I put off doing this much longer, I should never be able to do it at all, and that it was a desirable thing to be able to do it; to have one's information so arranged in his noddle that he could bring it forth fluently and without making a muddle of it. I use also a great many diagrams, etc., most of which I have to prepare myself and many of which are good for future use. I am preparing to give a course next year on "Mountain Form and Structure." My physical geography of North America course ends May 5, and then I am going at the gravel volume, hammer and tongs.

I am making some progress in Russian and find my old love of "language and the study of language" to have been only dormant these last twenty years. Have read a short novel, and some fairy tales.

TO BARON F. VON RICHTHOFEN

CAMBRIDGE, *June* 1, 1877.

MY DEAR BARON, — Your welcome letter was all the more welcome because it brought the news that a volume of your great work was finished. I am sure that no one will study it with greater zeal and interest than I shall, and I congratulate you most heartily on the auspicious event. It is all the more interesting to me because of late I have been working on the physical geography and geology of Asia, and as a proof of my desire to learn (even at my age!) I have, three months ago, commenced the study of Russian, in which I hope I am making some progress. I have heard of you occasionally through the papers, and noticed the frequently repeated statement that you had accepted a professorship at Bonn. When I saw you last, I was in great trouble; my wife seemed to be near the end of her life. I had hardly any hope that she would live through the winter when she reached home. After a year or more of much suffering from a sort of nervous fever, she began to get better, and now is much better, although invalided. . . .

The legislature of California has done nothing for the survey since I saw you. What I am publishing is at my own risk and expense, and I have not the support but the opposition of the Regents of the University. The first volume of the Botany was paid for, in part, by private subscription. The gravel volume will form one of the Memoirs of the Zoölogical Museum — I paying a considerable portion of the expense.

Hayden's work is of much greater value than Wheeler's, as the former has excellent assistants, Wilson of the California Survey having succeeded Gardner as chief topographer. Some of his other leading men are my pupils. . . . Hoffmann is in Virginia City. . . . Gabb is in Santo Domingo, always hard at work. Gardner is head of the topographical survey of New York. King's work is nearly done and will be all out this year. No doubt it will be a fine contribution to science. Pumpelly is at his home in Owego, N. Y. . . . I rarely hear from him, for he is a detester of letter-writing. I have been much interested in your contributions to the second edition of Yule's Marco Polo.

TO F. VON RICHTHOFEN

CAMBRIDGE, *February* 24, 1878.

. . . Last summer I spent a month in Nevada, part of the time at Eureka, and a few days at Virginia City. I went down into the "Hot Mines" and observed as high as 156½° Fahrenheit at the bottom of one (the water), the air from 130° to 140° Fahrenheit. I was intensely interested in the physiological results of this working in much higher temperatures than ever before known, and would gladly have spent the whole summer there. . . .

TO WILLIAM DWIGHT WHITNEY

CAMBRIDGE, *June* 3, 1878.

. . . I was just going myself this week to Philadelphia, to see Gabb once more, but I have just seen a letter from Baird to Allen, stating that he died on the 30th. On that very day he wrote quite a long letter with a firm hand to Louisa. I am glad he has not lingered in pain and sorrow. . . .

TO WILLIAM DWIGHT WHITNEY

CAMBRIDGE, *September* 22, 1878.

MY DEAR W. D., — . . . Take it easy, young man! don't be in a hurry to get back to work again. Have at least a summer's vacation. I wish that we had arranged to go up the Nile together, this coming winter! As for me, I start for the Himalaya to-morrow, via photographic line; that is, [William Morris] Davis arrives from India with 83 selected photographs of mountain scenery, which he says are fine. I also rejoice in a picture (in oil) by [William] Keith, of California mountain scenery, which adorns the hall of our house, and which was, so to speak, a present from Goodyear, who has come on from California with a lot of Keith's pictures, on speculation. They are now on exhibition in New York. Last night I returned from Trenton, N. J., where I have been looking up flint implements in the "drift," of which something in my gravel volume. The summer has slipped away and I have hardly done more than "clean house," including repapering the lower part and fixing up generally. Cleanliness is next to godliness, they say (who says?); that is my only chance, I fear. Now for hard work on the gravel volume! Meantime I have, with [William Henry] Pettee's help, prepared a supplement to the "Barometric Hypsometry," setting forth results obtained in California; and have, I hope, concluded the negotiations for completing the "Water-birds" in two magnificent volumes. Governor Stanford called on me yesterday (with $1,000,000 in his pocket for the survey), but unluckily I missed him. The Botany (II), for which the funds are provided, is stuck on Engelmann. How long he will continue to let us stick, I cannot tell. I am almost out of patience. . . .

Louisa's little book [a story of her life in England, entitled "Peasy's Childhood"] is done, and is lovely to look at. It is to be distributed to particular friends at Christmas; only fifty copies printed — from which you may infer that she (Louisa) has not more than that number of particular friends. Three hundred will be the number I shall have to dispose of, of my gravel volume; which I shall *not* give away to particular friends, but only to those on the big exchange list. The rest at $10 per copy (with a cast of Jo Bowers's [i. e. Calaveras] skull thrown in).

The enclosed extract fell under my eye in last evening's paper, after this was written. I never knew before what my religious faith was, but see now that I am a Unitarian.

The period of independent geological surveys by the several states was now drawing to a close: the United States Geological Survey was about to be born. The bill before Congress provided for a consolidation of the various government surveys under King, Hayden, Wheeler, and Powell; and for the directorship of the new organization, King and Hayden were the foremost candidates.

Whitney, appealed to for aid by both men, in spite of his personal feeling for his old friend

FAMILY GROUP

J. D. Whitney, Sr.'s, children and grandchildren under the Jonathan Edwards Elm in Northampton, 1878

and assistant, sided with Hayden on the ground that Hayden was the better man.

Hayden wrote from Washington, March 13, 1879, that he had learned that Whitney had been seriously considered for the position "as the first geologist of the age," offered his support in case Whitney were a candidate, and expressed his desire to serve under him should he be successful. To this Whitney answered:—

TO FERDINAND V. HAYDEN

CAMBRIDGE, *March* 15, 1879.

MY DEAR DOCTOR,—Your letter of the thirteenth was duly received. It was not exactly from the motives you suggest that I declined to endorse King, as requested by his friends, "as being the best man in the United States for the place." King has been my friend and pupil, it is true; but you have worked hard and indefatigably, and I did not feel called on to put myself in opposition to you. I remembered how much my brother (Professor W. D. of Yale) thought of you and your work, and what a good report he brought of his summer's campaign with your party [in 1873].

Moreover, I did not wish to do anything which should give any one a right to say that I myself would not accept the place if it were offered to me in such a way that I should have a right to feel that competent authority had adjudged me the most suitable person for the place. I say again, what I said two months ago to King, that I do not want the position, and that I would not put myself forward in order to obtain it. It does seem to me, however, that it is a place that almost any working geologist in the country would be glad to have, if he could get it *on the square;* and that such as did not want it might, very likely, feel it a duty to take it, if they had a chance. Remembering how hard you have worked in early days, and under what disadvantages — and in regard to this I have already expressed myself most clearly in print — I cannot but sympathize with you in your efforts to keep possession of the work you have managed with so much ability. And I may add that I have felt chagrined at the attacks made on your private character by those [i. e. the army engineers] who were seeking to oust you.

If you succeed in getting the appointment, I shall be one of the first to congratulate you, and to offer you a lot of good advice as to the way I think the work ought to be done; and I hope you will not blame me for believing that in everything there is always room for improvement. What I would particularly urge would be that the geological work should be made more practical.

Very truly yours,
J. D. Whitney.

King took his former chief's decision in good part. "I do not doubt," he wrote at once, "that your reasons are sound and good. . . . I have no blame for you in the matter. I believe you always act fearlessly and as you think strictly right. No man can do more." Thereupon King turned the tables on his rival by getting Brewer to see President Hayes, and convince him that King and not Hayden had been the heir of Whitney's topographical method, and had introduced it into the Government surveys. So the unpaid volunteer whom Whitney broke in on the trip to Lassen's Peak, in 1863, became in 1879, in spite of Whitney, head of the United States Geological Survey.

CHAPTER XIII

THE LAST OF THE CALIFORNIA REPORTS.

1879 TO 1882

WITH the spring of 1879, Mrs. Whitney's health was so far restored that she could venture once more on a journey, not this time around the world, but to the familiar ground of Europe. Some account of this trip appears in a letter, written after the return to Cambridge.

TO F. VON RICHTHOFEN

CAMBRIDGE, *February* 9, 1880.

MY DEAR BARON, — Your favor . . . is just received and I will try to earn again the title of "faithful correspondent," to which I have certainly not maintained any claim of late. On my way to Europe last spring I was taken sick with a malarious attack (relic of the Wisconsin Survey); trying to make it out to be nothing, I kept moving, although really sick and unable to do anything, while a week of rest and nursing at home would have easily cured me. At Vienna I was still only able to get about a little. I did get your letter, and saw Hochstetter, as well as many others of the scientific men. Of Pošepny ["the only one besides myself who is a specialist in mineral veins"] and Steindacher — both of whom had been our guests either at Cambridge or San Francisco — we saw a good deal; and they were exceedingly kind and hospitable.

The great event at Vienna while we were there, was the production of the "Niebelungen Ring," which I managed to sit through and enjoy, by dint of staying in bed most of the daytime. In Trieste I was sick for three days; in Venice I began to feel a little like myself, and after six weeks in the Upper Engadine, was all right again, although it was fearfully cold. My wife improved in health all the time we were abroad, and my daughter gained somewhat. We went down the Rhine and passed Bonn the latter part of August, when I knew that you would not be there.

From the Rhine we went to Paris, where we stayed some time, and my daughter became engaged (*verlobt*) to an American artist, living for the time at Écouen, a few miles away. He is the son of a prominent and wealthy man, born in Massachusetts, and now of St. Louis, name Allen. The marriage is expected to be here next June, and the young couple to return to Écouen in the Autumn. I ought to have written you from Paris; my excuse must be that we were head over heels in excitement.

My brother (William) and all his family were there; and previously at the Axenstein (on Lake Lucerne) we gathered ten members of our family around the table. My brother, during the year he was abroad, completed and published, in English and in German, his Sanskrit grammar, and he is now at home at work on his long since promised second volume of the "Atharva-Veda." I am just sending to press the first pages of the concluding part of the gravel volume, two having been already published. . . . King is figuring at Washington for enormous appropriations, intending to monopolize the geology of the entire country. Should he succeed, I shall probably abandon Californian geological work, as I cannot compete with the United States. I have a large quantity of material on hand; but it won't pay to publish it; there will be no sale, as all the geology of the country will be distributed from Washington gratis.

In the meantime there was need of more facts on the California gravels, and Whitney sent his assistant, William Henry Pettee, into the Sierra Nevada; while another assistant, Marshman Edward Wadsworth, went into northern Michigan, to secure ammunition wherewith to repel certain new attacks on the conclusion of Foster and Whitney's old Lake Superior reports. The results of Wadsworth's work appeared in 1880 as "Notes on the Geology of the Iron and Copper Districts of Lake Superior."

TO WILLIAM DWIGHT WHITNEY

CAMBRIDGE, *December* 24, 1879.

MY DEAR W. D. W.,—. . . Ice on the brain is the trouble with me at present, for I am in a very inflamed condition on the so-called "Great Ice Age," about which I am trying to work my ideas into shape.

My fellow graveler has returned from California, and I expect him here in a few days, to go on with writing up his notes. As soon as possible thereafter, I shall begin printing the final part of the gravel volume. Mr. Wadsworth is going over the whole ground of our Lake Superior work in the light of the new lithological methods, having spent the summer on the Lake. I hope he will be able to show up the iniquities of Sterry Hunt & Co. and rub up the tarnished glory of F. & W., till the old pewter plates shine as good as new. I feel the greatest confidence that we were right on every one of our main points.

King's operations are becoming a source of a good deal of interest to some geologists, including your humble servant. I hope you read Dana's article on the subject in the last A. J. S.

TO WILLIAM DWIGHT WHITNEY

CAMBRIDGE, *March* 13, 1880.

MY DEAR W. D.,—I believe I never was so driven as I am this winter. The devil (printer's) is after me every day to the tune of three quarto pages of proof and three of revise—besides lecturing and looking after all the odds and ends of Pettee's and Wadsworth's work, etc. When you come on, I mean to take a vacation. Before that time, I mean to have the most difficult part of my present work in type and can rest before beginning on the remainder. Dress-goods, outfits, and the wedding [of his daughter] are the prominent topics discussed in the house outside my sanctum.

TO WILLIAM DWIGHT WHITNEY

May 9, 1880.

I send the "Climatic Changes," and is n't this one of them? And are n't you glad you are back home and have n't got to go to Solomon's to-night; and *überhaupt*, what is the world coming to with the mercury at 91° early in May, and is it the sun-spots, after all? *Dies irae, dies illa, solvet saeclum in favilla*,—no wonder Sybilla was testy about it!

TO WILLIAM DWIGHT WHITNEY

CAMBRIDGE, *July* 3, 1880.

. . . I did arrive just in time to welcome — several batches of proof-sheets and maps, and to give my blessing (?) to [Sereno] Watson, who starts for the far West to-day . . . leaving the Botany for me to finish up and publish. I also learned on my arrival that Pettee, whom I had counted on for a month's help in July, was about to fail me, having had a "loud call" to go to Colorado for the summer. So here I am tied down, for six weeks at least. If I can get a couple of days ahead of the printer, I will surely run up and get a breath of (Horse) mountain air. . . .

This weather will, I fear, cast a damper on the bridal pair. . . . Let us hope that the rain will last long enough to put out the fire-crackers and the small boys of the Fourth.

TO WILLIAM DWIGHT WHITNEY

CAMBRIDGE, *August* 6, 1880.

Yours of the fourth from Bethlehem — after which you could not properly write "jewed here," to judge from the price you pay for a letter-box — has arrived. As now is a good opportunity to read up what you otherwise might neglect, I send you Wadsworth's article on Lake

Superior. I don't feel so much the necessity of going there as I did, as you will naturally infer when you have read the article. Still I would like to have another look at the country, and to strike a few stronger blows in favor of the old firm of F. & W. to rivet the bolts that Wadsworth has stuck in. Seems to me that metaphor is getting a little mixed. It is all owing to my having just been writing about a steam boiler carried down a ravine by a cloud-bust in California.

I shan't make any plans for travel until the gr. vol. is done. Botany II goes on to the press next week, as well as a second edition of I. Then the "Gravels" will be ready to follow.

TO WILLIAM DWIGHT WHITNEY

CAMBRIDGE, *October* 8, 1880.

. . . The last page of my works — at present to be printed — left the press to-day. All will be in the binder's hands by Wednesday next. My edition is differently put together from that of the Museum, and will form two quarto volumes of about equal size, of which only one appears now, entirely devoted to the gravels. The other contains the fossil plants and the "Climatic Changes." Only the Museum copies of Part I of "Climatic Changes" are now to be issued.

TO WILLIAM DWIGHT WHITNEY

CAMBRIDGE, *December* 31, 1880.

. . . Our recess ends on Monday and I begin lecturing that day. I have two courses now: one on dynamical, and the other on economical geology. Both take much time in the way of preparing diagrams, etc. I expect soon to begin putting the second part of "Climatic Changes" in type. The work on the birds ("Water Birds of North America") is now fairly begun, the cuts being all done and delivered, as well as the MS., 520 odd cuts and a pile of MS. three feet high.

TO WILLIAM DWIGHT WHITNEY

CAMBRIDGE, *March* 30, 1881.

MY DEAR W. D. W.,—The Mirza Johann Arsenias, a Persian, . . . called yesterday . . . and seemed to have a good deal confused me with you, as you are aware others have done before him. He wants to teach Syriac and Turkish, and seemed to be desirous, when he found out that W. D. and J. D. were two distinct entities, of having me write to you and ask if he might perhaps get any pupils in New Haven, he having an idea that he might divide his valuable services between the two institutions to which we respectively (and respectably, I trust) belong.

Do you need any Syriac at your place? This man with the poisonous name has lived in Constantinople, St. Petersburg, and London, and at each place done translating work for some governmental concern.

I sent on A. Gr. and Bot. II this morning. Tell Brewer, if you see him, that I don't feel very happy at Eaton's having omitted all notice of the California Geological Survey in connection with his praise of the Botany — which one would imagine, from the way Eaton puts it, had grown to maturity without any connection with the Geological Survey or with your humble servant, who took the risk and advanced a large part of the needed money, paying Watson and Gray respectively for their work, and doing most of the *drudgery* himself without remuneration.

TO WILLIAM DWIGHT WHITNEY

INNSBRUCK, *July* 1, 1881.

MY DEAR W. D. W., — This is to certify that we are alive and well and so far on our travels. We went directly from Paris to Turin, thence to Genoa, Florence, Bologna, Venice, Villach, Toblach, Cortina d' Ampezzo, and Innsbruck, having been just about a month on the round. From here to the Salzkammergut, thence to Munich, and to join Eleanor . . . at Écouen [where the Allens made their home] August first for a month more somewhere. We sail from Liverpool for Boston, September fourteenth. . . . Louisa is well and enjoying the journey very much. . . .

Nothing has been heard directly from you as yet; but the papers inform us that you were at the Greek play at Harvard. They omit to say how you enjoyed it. According to Pettee's account it was a great success. . . .

Travel has hardly begun yet in these parts, so that we can have all the accommodations we need without scrambling for them. I never knew before how beautiful Italy is in summer, that is, in the beginning of summer. The Dolomites I revisited after an absence of nearly forty years. They are still there! And grander than ever.

TO WILLIAM DWIGHT WHITNEY

LEIPZIG, *July* 23, 1881.

MY DEAR WILLIAM, — . . . The glaciers are "going, going, gone" in the parts of the Alps where I have been this year. The Ortler Spitz looks very different from what it did forty years ago, as I can testify, and I have secured some fine photographs which show the thing in great perfection. . . . I have put in a few "good licks" in the geological way, and got some valuable documents and information, as well as a few fine photographs. One place we have visited this time which was new to me, Ratisbon. The "Walhalla" is most superb! and the Cathedral not to be sneezed at.

TO WILLIAM DWIGHT WHITNEY

CAMBRIDGE, *October* 2, 1881.

MY DEAR W. D. W.,—We arrived on Wednesday . . . and in good health and spirits after a very rough and disagreeable trip. . . .

Of course there is the usual mountain of work to be climbed, although I have as yet done nothing but run round and attend to miscellaneous business. The principal task of the coming year will be to finish the "Climatic Changes." An elaborate paper on another subject has been in hand for a year or more, and will probably be published this year as a joint *Arbeit* of Wadsworth and myself. . . . Of lecturing I shall have little to do this year. Last year I devoted almost entirely to it. When I do resume lectures, I shall give the second part of my course on dynamic geology, or that relating to volcanicity and mountain building—say fifty lectures—for which, however, a large amount of work, as preparatory, will have to be done, both in study and in preparation of diagrams. When this is done, I shall have the "stock and fixtures" of two courses of lectures—say two hundred in all.

When shall we meet again? I do not foresee being called to New York this year, but mean to go to Northampton soon. Could n't you come up and spend a day at Northampton?

TO WILLIAM DWIGHT WHITNEY

CAMBRIDGE, *March* 12, 1882.

MY DEAR W. D.,—Since you were so kind as to say that you would read over the electrotyped pages of the "Climatic Changes" II before the printing was done, I now send on a package, by express, containing all the remainder of chapter two and all of chapter three except, perhaps, fifteen pages not yet all in type. I have decided to issue this at once, leaving chapter four, which forms—so to speak—a distinct division of the work, to follow about three or four months later. People are beginning to edge over on to my ground, and I would like to secure as much priority as possible for my ideas; besides I shall not feel so much hurried with chapter four if this on hand is issued.

I flatter myself that reading this stuff I send you will be rather easy, and hope that I may hear that you even smole a smile occasionally, in perusing it. No one has read it except Mr. [Alexander] Agassiz, who was kind enough to express high approval; but I want from you some criticism, and especially of any slips in style, which may have escaped my notice, and which it may be worth while to correct — at 60 cents an hour!

The letter, or perhaps the telegram, to which the following is a reply is no longer extant: its nature, however, is not hard to guess. Rev. Nathan Birdseye is a maternal great-great-grandfather who preached his last sermon a year or two before his death at one hundred and three.

TO WILLIAM DWIGHT WHITNEY

CAMBRIDGE, *April* 24, 1882.

MY DEAR W. D. W., — The aged grandfather totters to his writing-table to address you a line of thanks for your congratulations. I always felt curious to know how Nathan Birdseye felt as he drew toward the eighties after his graduation; now I know how it is myself. We have as yet only the bare cable message, and await the details of the great event with no little anxiety. The "hen with one chicken," you will naturally exclaim. When we hear farther we will communicate the news to you; meantime we trust that *la petite Française* is all right, as well as *Madame la Mère*.

TO WILLIAM DWIGHT WHITNEY

CAMBRIDGE, *May* 10, 1882.

MY DEAR WILL, — When one has bad news to communicate, it is best to plunge in at once. This has been a week of heavy trouble. Louisa was operated on, Tuesday, for strangulated hernia. The doctor will give no satisfactory assurance that she will recover; although to me, knowing her constitution so well, her symptoms do not seem so very unfavorable.

Tom telegraphed on the very day after the operation, that Eleanor was dangerously ill from the results of an abscess. Another telegram yesterday was not favorable; indeed it was very much the other way.

TO F. VON RICHTHOFEN

CAMBRIDGE, *June* 9, 1882.

MY DEAR BARON, — Your letters of May tenth and twentieth were duly received, that of latter date this day. The card which was sent you some three weeks ago has, no doubt, reached you, and told you how at one blow I was left alone in the world. You saw enough of us in California to know how happily we lived together — my wife, my only child, and I. In 1874 we again met you in Berlin, my wife then a sad invalid, my daughter a blooming girl of seventeen, whom we had left at Hannover, that she might learn to love Germany and German ways —which she did, becoming a child of the house, in the family of dear friends there. When we left Europe to return, in 1874, I fully believed that my wife had but few weeks to live; and she thought only of reaching home, so that she might die among friends, and in her own country. But after months of suffering, during which she wrote two volumes (which were afterwards published for distribution among her friends), she rallied, and for most of the time after that, seemed to enjoy a tolerable measure of health. In 1879 we again went to Europe, but did not see you. Most of that summer we spent in the Engadine, my daughter not being strong, although well enough to enjoy life. The next year she was married to a man, whom we all soon learned to love, a young artist, son of a very noble and influential man, Thomas Allen of St. Louis, one of the finest types of an American. In the autumn of 1880, my daughter and her husband returned to Europe and took up their residence at Écouen, near Paris, a favorite resort of landscape painters. Here last summer, just a year ago, we found them living in idyllic happiness, every possible blessing seeming to have been showered upon them. Together we visited the Channel Islands, where they spent July and August; and thence went to London, where mother and daughter parted, never again to meet in this world. . . .

June eighth, however, my wife was seized with a sudden and violent illness, which proved to be the result of a strangulated hernia. She was operated on for it at once; but sank away after the operation, and died on the thirteenth, without having suffered much pain or having had any clear idea that her end was so near. The day after the operation, came a telegram that my daughter was in the greatest danger; and she, dear, lovely girl, followed her mother only a few hours later—neither having known anything of the other's condition. Only two days before her death, my wife told the doctor how happy she was in feeling that Eleanor had everything that could be asked for, and that her cup of happiness was full to overflowing.

My wife was buried at Northampton—one of the loveliest spots in the world—where Eleanor and I were born; and there the dear child will be laid to rest, beside her mother, probably on the second anniversary of her marriage. And I am alone—nothing left of my own family but a little granddaughter, six weeks old. . . . In about a week they will start to bring back the living child and the dead mother. Such is my sad story. I have told it to you in brief, because I felt that you saw enough of us in our happiness in California, to wish to know something of me in my sorrows. . . .

TO F. VON RICHTHOFEN

CAMBRIDGE, *June 21, 1882.*

MY DEAR BARON, — I thank you most sincerely for your kind and sympathising letter of the third, just received. A few days ago I did write you something of myself and my sorrows. My son-in-law, Mr. Allen, is now on his way home with the baby and all that is left of his dear wife and my beloved daughter, of whom, as you say, I was so proud. I shall wait with anxiety to know where he intends to live and what he means to do, before making any change myself. In the meantime, I am trying to finish the "Climatic Changes," of which about a hundred pages remain to be put in type. As my strength may not hold out to do it, or as delay may arise, I send you by mail a copy of the work, so far as completed. You will see from the circular enclosed, what my plans are; or rather what they were at the beginning of last month, when everything looked so bright to me.

Please present my sincerest regards to your wife and thank her for her expressions of sympathy and accept the same for yourself, from your very sincere friend, J. D. WHITNEY.

CHAPTER XIV

THE CENTURY DICTIONARY

WHITNEY had always been a solitary man, who found his happiness in his family and in his work, rather than in his friends. For several years after his great sorrow he lived in retirement, and from this seclusion he slowly and only partly emerged. In time, nevertheless, his wonted cheerfulness came back; if he was not happy, he was at least content.

Whitney was now, for the first time in his life, established in a permanent abiding place under his own roof. In 1885, he gave up the dwelling on Oxford Street, which for fifteen years he had rented of B. A. Gould; and bought No. 2 Divinity Avenue, on the same street with the Agassiz Museum, and only a hundred or two yards away. It is a dignified old house, and the library, which takes up the entire street front, is counted one of the most beautiful rooms in Cambridge. This house soon became the family centre, in place of Northampton; for J. D. Whitney, senior, had died in 1869 and his wife in 1876, and the sons and daughters were resorting less and less to their old home.

But though sisters and nieces made long visits and filled in some measure the place of wife and daughter, the Sturgis-Hooper Professor of Geology remained his own housekeeper. His is by no means the only case in which a successful administrator has taken on the care of a household, and found the task easy to his practiced hand. Mrs. Whitney's uncertain health had from the first made her husband familiar with domestic matters; a lifelong interest in all beautiful things had given him a discriminating taste in household furniture, and he took a real pride in his "new old" house. His home-making methods were characteristic. He picked his maids carefully, paid them well, worked them lightly, judged them by results, specified that they should be called Mary for the convenience of Mrs. Whitney's parrot, and kept them for years. Every day he walked to Harvard Square and did his marketing.

His beloved books came also to rest, the less technical portion at his house, the working library in two ample rooms in the Museum building, where it still remains, the property of the University. Here, after 1882, was his work-room, on the second floor, in the sunny corner of the north wing, where he could look out across the quadrangle to the Divinity School and his own house.

The life of a university professor, long established in his chair, is apt to be an uneventful one, happy indeed if it has no history. For Whitney it was a life of steady and pleasant toil, diversified by daily walks about Cambridge or into the country, and by summers spent with his relatives, usually at Lake Placid in the Adirondacks, on the South Shore of Long Island, or at Lake Sunapee, New Hampshire.

One special solace he had during the comparative leisure of his later years — his love for music. Several of his nieces were skilled musicians; and during their long visits especially, there was much musical company. He played no more on any of the eight musical instruments of his youth, but he had made to order the best piano that could be built, and he belonged to a small club of musically minded people, who imported new music, and met regularly to study the works of new composers. His special joy was the concerts of the Boston Symphony Orchestra. For these he had always two tickets; and he was accustomed to secure the programs in advance, and to send to Europe for the scores of unfamiliar works. Thus his musical library became in time no less remarkable than his other collections of books. It is related that Professor Paine, head of the department of music in the University, once called on the professor of geology to see whether, by any chance, Whitney possessed a certain musical work not owned by the college library; and when this was promptly brought forth, proffered with equal success a second and then a third like request.

TO WILLIAM DWIGHT WHITNEY

CAMBRIDGE, *September* 16, 1883.

MY DEAR W. D. W.,—We returned from our little trip to the White Mountains on Friday, having been immensely favored by the weather, during all the nine days of our absence. It was cool enough to make walking a pleasure, and a fire in the house a comfort. It always rained a little just before we had to ride in any direction, so as to lay the dust; and—greatest favor of all by far—we had an exhibition of the "frost-work phenomenon," or frost feathers, as some call it, gotten up on Mt. Washington for our special benefit. I was quite unaware that it had ever been seen in summer; or rather, at any time except midwinter, and could not find out from any one on the summit, that it ever had been. I saw a good deal of the country, ascended Kearsage, Mt. Washington, Sugar Hill, and Bald Mountain—points just suited to give me an idea of the glacial conditions. Never was a greater absurdity broached, than that Mt. Washington has been passed over by an ice-sheet. I could not find anywhere in the White Mountains any proofs of anything other than local glaciation, and not much of that. I also examined the "Flume," through which the "avalanche" went last June, and saw that the famous "boulder," which had been put up in the Flume by *ice*, according to the glacialists, had been carried away by *water*, and carried a thousand feet, although more than 10 feet long. Also other things too numerous to mention.

TO WILLIAM DWIGHT WHITNEY

CAMBRIDGE, *September* 19, 1883.

MY DEAR W. D. W.,—In regard to Brother B.'s dictum touching the "Continental Ice Sheet," I think that he will find that he does not know as much about it as he thinks he does, when he reads Vol. IV of the "Contributions to American Geology." (Volume III is well under way now.) I have studied the subject more thoroughly than he has, and have had better opportunities than any one—so far as I can judge—for observing. I have studied every glaciated region of importance, except the polar, over and over again.

The only professional geologist who has ever visited Greenland, Laube, writes me that my views entirely coincide with his. Nordenskjöld has just discovered—what I published two years ago—that Greenland is much less accessible than it was five or six hundred years ago. Richthofen, now Professor of Physical Geology in Peschel's place at Leipzig, writes that although my views are hard to swallow, yet he does not see how the evidence I offer can be overcome, etc. As for Mt. Washington, I can bring positive evidence that no ice-sheet ever passed over that point. It is very likely that I shall, before long, issue a sort of forerunner of my glacial ideas. . . . All I claim at present is that I know very little about the causes and conditions of the glacial phenomena in northeastern North America; while lots of young fellows, who never saw a glacier in their lives, "know all about it"—as the servants in Goodwin's kitchen about God.

TO WILLIAM DWIGHT WHITNEY

CAMBRIDGE, *October* 7, 1884.

MY DEAR W. D. W.,—I am glad that you think that we have been temperate in the tone of our "Azoic System." Nobody can tell what an amount of work on my part and on that of Mr. Wadsworth has been put into that volume. Time will settle the question whether we are right or not; if we are, we deserve some credit, I think. Dana hates to give up his name

Archæan, but he has to admit that we have settled the question of the subdivisions of the Azoic or Archæan. Quite a number of the younger geologists have written, expressing adherence to our views. We do not expect much from the older ones. . . .

C. A. White of the United States Geological Survey was here to-day, just back from California, where he has been going over my ground, with my books in his hand. He was gracious enough to admit that he had not been able to find that we had not done our work well. In fact, he expressed surprise that we had been able to accomplish so much.

Benjamin E. Smith was managing editor of the Century Dictionary and William Whitney its editor-in-chief. By 1883, the original project for a revision of the old Imperial had grown into the plan for the great work which finally appeared in 1889. Not unnaturally, the chief editor turned to his brother for assistance with the mining terms.

TO WILLIAM DWIGHT WHITNEY

CAMBRIDGE, *May* 15, 1883.

DEAR W. D. W.,— . . . As for the dictionary work, it is astonishing with what skill the mining words are defined in the Imperial

Dictionary. I mean, skill in missing the point. If I am to do the mining terms, I must have the metallurgical and geological, for they cannot be separate. In the selection of words included under mining, the Imperial is as bad as or worse than any other dictionary—there has been neither rhyme nor reason about it. It is evidently the work of one entirely unacquainted with the subject, as I feel sure I could demonstrate, if you won't take my word for it. Many important words are omitted, and some introduced which are defunct and have been for centuries—if ever alive. What shall I do?

TO WILLIAM DWIGHT WHITNEY

CAMBRIDGE, *May* 16, 1883.

MY DEAR W. D. W.,—I am sorry that you did not tell me at first, that the subjects of geology, mineralogy, and metallurgy had been assigned. . . . Had I known this, I should never have dreamed of offering to undertake the mining terms. . . . Anyway I could not do justice to the subject without a great deal of labor and some space to display the results. A separate polyglot work, embracing geological, mining, ore-dressing, and metallurgical terms, is what is needed, and the especial interest would be in tracing the history of the mining art in its progress from one country to another. In no dictionary that I have examined, has there been any evidence found that the author of the definitions of the mining terms has had any practical acquaintance with the subject.

The Imperial illustrates this statement better than any dictionary I have met with. I cannot understand why there should be this fatality with regard to the mining words especially.

William Whitney's solution of the difficulty was simple enough: Josiah kept the mining terms, and became responsible in addition for metals and metallurgy, lithology, geology, physical geography, and for want of a better man, of fossil botany besides. It was largely a labor of love on his part, for he took vastly more pains than he was paid for, sent abroad at his own expense for books to prove usage, and in addition to his own work, kept an eye on all the scientific definitions, and revised the entire proof. A by-product of this labor was "Names and Places," which appeared in limited edition in 1888, a curious little book full of strange lore concerning the terms of geography.

In the meanwhile, Whitney kept on with his geological publications and his teaching.

TO WILLIAM DWIGHT WHITNEY

CAMBRIDGE, *August* 25, 1885.

MY DEAR W. D. W.,— . . . The sail to Rockland, where we only stopped five minutes, and from there to Boston, was still, calm, and comfortable, and the sunrise, as we approached Boston Harbor and all the Smiths (i. e. *genus humanum*) of Boston, was lovely. I never sailed up the harbor before under favorable circumstances, and hardly ever before was in the business part of the city on Sunday morning. It was a curious sensation. I should mention that we arrived at seven o'clock exactly. On the boat I picked up a piece of a Bar Harbor newspaper, in which it was stated that the Island of Mount Desert was named in honor of De Mons, a French officer. I knew this was absurd, and so looked up the name in Champlain, and here copy what he says of it in the edition of 1632. (The earlier one has nearly the same thing in a little more antique spelling.) ". . . Je l'ay nommée l'isle des Monts-deserts" (island of the barren mountains, or barren-mountain island—for "desert" really means a mixture of barren and uninhabited, or that which is uninhabited because it is barren). You see that the theories that the mountains have been laid bare by fire, will not hold water,—that is, unless it was done before 1607. . . .

This rain is splendid for washing off new paint! It will clear the outside of my house off as slick as a whistle.

Them peaches $\overset{\text{must}}{\underset{\text{shall}}{\text{will}}}$ not be forgotten!

TO WILLIAM DWIGHT WHITNEY

CAMBRIDGE, *December* 28, 1885.

MY DEAR W. D. W.,—I have received a package addressed in the most legible manner:

"Professor C. D. Whitney
Yale College
Cambridge, Mass., U. S. A."

Is it for you, or me, or for neither of us? P. S. On opening the same, at a venture, I found it to be a German-English grammar, by one Meissner, evidently intended for me, since to send a German grammar to you, would be expressing coals to Newcastle. However, if you desire it, you can have it for fifteen cents, the amount U. S. demanded of me, in the way of duty. Should this grammar fall into your hands, I would like you to read an exercise on "Climate," near the end, as a remarkable specimen of the kind of stuff in common circulation and believed in by many, in reference to historic changes of climate.

TO WILLIAM DWIGHT WHITNEY

CAMBRIDGE, *March* 27, 1887.

MY DEAR W. D. W.,—Will you give instructions to B. E. Smith that my definition of the word Archæan be put in the place of that in the C. D. (see galley-slip enclosed)? I have written it with care, following very closely A. Geikie, and sacrificing myself, inasmuch as I have admitted that Dana's name has in general use replaced mine. Not that I believe at all that his is philosophically correct, since I feel sure that, in the future, they will come back to mine (i. e. F. & W.'s). Furthermore: I will now say, once for all, that I will do no more work on the C. D., until I receive assurance that my definitions will not be tinkered, and that alterations will not be made in them without my consent, and that all words of which my definitions form an important part shall be submitted to me for approval, before being put in type. Only on these conditions, which are substantially those which I was originally given to understand would be those prevailing with the experts, will I proceed with the work, which is one of great labor, and one from which I shall get only worry and disgust, if my carefully written definitions are to be tinkered by one entirely unacquainted with the subjects to

which they belong. I must also add that, if things go on as they have gone, I shall be obliged in self-defence to disclaim all responsibility for anything in the C. D., and to publish a glossary of words in my department, in which the Smithian interpolated portions are left out. I await an answer before proceeding any farther.

You have probably not heard that I have been elected Foreign Member of the Geological Society of London, an honor which I share with three Americans: J. D. Dana, Jas. Hall, and Newberry. So far as I can judge, it is chiefly in recognition of the value of the "Azoic System," which treads pretty heavy on some of the older geologists' toes, but the newer school is in office in the Society now. *Lis sub judice est*, i. e. Judd is president, and Murchison and Carpenter defunct. *Les absents ont toujours tort.*

P.S. I would not wish you to infer that I am not willing to receive hints and information and new words, even if they be not to be found in my glossary in 37 languages—say, as has been the case in Tartar. But I will not consent to any words being admitted on which no light can be thrown, save that they are in *another dictionary*. I am continually trying to impress it on the Smithian mind, that dictionaries are no authorities. You have already got some "gimcracks" in the C. D., and very seedy they look! . .

This sputter on the part of the editorial contributor, it is only fair to say, is merely a bit of the inevitable friction between the two sides of every publishing enterprise. Whitney and his managing editor remained excellent friends. On "azoic," however, Whitney was fairly beaten; for the era proves to be by no means lifeless. Aside, nevertheless, from mere names, to Foster and Whitney's old report belongs the credit of first recognizing distinctly the importance of this formation in North America.

TO WILLIAM DWIGHT WHITNEY

CAMBRIDGE, *July* 1 (almost), 1889.
Ther. 85°, will be 95° to-morrow.

MY DEAR W. D. W.,— . . . I think I shall stick by this village until the summery, simmery school has sizzled out. Please give me one more item of information, viz., where you recover your express matter. I might want to send a package of novels in case the children should cry for the same.

I am not of the same mind as you, in regard to the criticisms of Newcomb. I think they were just, and argue that he had a good opinion of the dictionary in general, or he would not have condescended to spend his time on it. I distinctly remember my surprise at the definition of "alidade," and wondered who could have been responsible for it. A very considerable number of definitions of this kind I have already rewritten. I never received any thanks for this; and in fact, I rather inferred from the tone of the letters received, that such criticisms were unwelcome. Sometimes I have said that such and such a word was absurdly defined, and offered to rewrite it; but have received no response. Sometimes I have rewritten, and my word has (I suppose) been adopted. I recollect particularly "horizon" and "artificial horizon," the former of which words was incorrectly and incompletely defined, and the latter absurdly. I rewrote both from beginning to end, and suppose that my words were accepted. Almost all the definitions of surveying instruments have been bad. When they were very bad, I have sometimes called attention to the fact, sometimes rewritten them, and sometimes (I guess) let them go; partly, because it was none of my business, and partly, because (in some cases, at least) I had not the time to hunt up the information needed.

TO WILLIAM DWIGHT WHITNEY

CAMBRIDGE, *September* 5, 1889.

MY DEAR W. D. W.,— . . . I find some pretty bad things . . . but not many. A good illustration of the old proverb, "A little knowledge is a dangerous thing," is afforded by the word "lapilli," which I have tried three times to have so printed, but which they persist in making into "capilli." I tried, also in vain, to have what is said about "Bavarian bronze" stricken out, on the ground that there is no more any Bavarian bronze than there is Berlin, Parisian, or Chicopee bronze. There is no peculiar kind of bronze made in Bavaria. On the contrary, there, as everywhere else, the composition of the bronze varies with the time and the maker.

The worst thing . . . is the definition of "astrolabe," which is all wrong; and the figure given is not that of an astrolabe, although some one may ignorantly have called it so. In fact, as a general rule all through the C. D., the definitions and descriptions of mathematical and surveying instruments have been bad and sometimes ludicrously so. I have rewritten a good many of them, but it seems rather hard to put this additional work on me.

In weights and measures I have much to

find fault with; for instance under "arschin" . . . the expert evidently has no idea what an "arschin" is, nor that the Russian and English measures of length are identical. An arschin is not a measure "formerly in use," and it is not "about 28 inches," it is exactly 28 inches. In fact all that relates to weights and measures is almost always bad. What is to be done?

The twenty-third of November, 1889, was Josiah Whitney's seventieth birthday, and his brother William, thinking "the anniversary too important and interesting to be passed without notice," proposed to despatch one of his daughters to Cambridge, "to bear the congratulations and good wishes of this branch of the family to the head of the family." His birthday gift was appropriately a copy of the "Septuagint."

TO WILLIAM DWIGHT WHITNEY

CAMBRIDGE, *November* 21, 1889.

MY DEAR W. D. W.,—What is the use of making such a fuss because a fellow has got to be 60 years old! Don't let M—— come on Friday, but wait until Tuesday next. Then, she can hear a Sarasate-D'Albert concert on Wednesday, and another on Saturday, and two symphony concerts into the bargain. I have already given away my tickets for this week's concert, for I was thinking of running down to New Haven on Saturday, to spend a part of Sunday with you, if you don't object; and then you can congratulate me on my having reached my 50th birthday, if you think there is any great merit in that. Besides M—— must come with M—— and hear her great rival on the fiddle! Answer at once, by telegraph, if you agree to all this, for I must make arrangements for getting the tickets, which there will be a scramble for.

Your 40-year-old brother,
J. D. W.

FROM WILLIAM DWIGHT WHITNEY

New Haven, *November* 22, 1869.

Dear Jo.,—We are much more than satisfied to have you come here instead. Bring a Boston Glee-book, if convenient. Pity that the girls can't go as you kindly propose; but M—— has a friend coming. . . . Otherwise we should send them, spite of Th'ksg'ng.

It was lucky that you did not have to write a longer note, or by the end of it you would n't have been born yet.

Come as early as you can.

Yours ever,
W. D. W.

TO WILLIAM DWIGHT WHITNEY

CAMBRIDGE, *November* 24, 1889.

Hall°!

Hall°!

What you sent me as the LXX version of the Old Testament is, in fact, the LX-andrian! Please take off ten years from that account. Be that as it may, I had n't had the book ten minutes before I had utilized it in my dictionary work. (See maltha.) In fact, strange as the coincidence may seem, I was just going over to the College Library to get the second volume, and see how the Greek stood in reference to the cement used in the Tower of Babel (not by Rubinstein), and which the authorized version calls "slime." So you see your book was cold water to a thirsty soul—in spite of the attempted and easily detected falsification of the age of the donee. . . .

Yours with a
Nathan Birdseye view
into futurity,
J. D. W.

TO WILLIAM DWIGHT WHITNEY

CAMBRIDGE, *December* 21, 1889.

MY DEAR W. D. W.,— . . . What do you say? Shall I come down . . . and spend Wednesday evening with you . . . ? I could not inflict myself on you for longer than until Thursday morning.

If you don't answer this, I shall conclude that you don't want any more Whitneys around—have got enough of 'em of your own. If you telegraph on Monday morning . . . why then all right. I will come unless influenz'd to the contrary. . . .

H—— called my attention to a review of the C. D. in the . . . "Atlantic." The first thing I noticed was that I had misspelled the name of Skeats all the way through "Names and Places." I sent . . . down town at once for a carriage, and rushed upstairs to pack up, ready to be taken to the idiot asylum. Just after finishing the job, and while waiting for the carriage, I went to the closet and took out Skeats's book, intending to kick it in revenge for the woe it had brought upon me. When (Lo and Behold!) his name was Skeat after all! Now don't you think a man who all through a critical review of a Dixonary misspells the name of the author he quotes most, ought to be hung?

TO WILLIAM DWIGHT WHITNEY

CAMBRIDGE, *December 28, 1889.*

MY DEAR W. D. W.,— . . . Have they written a decent definition of "Atwood's Machine"? I called attention to the fact that, as set in the galley proof, it was simply awful, and it did not come changed in the page proof. Look sharp after that word. I have also sent messages to various great bolt and screw manufacturers, to find out exactly what a "machine bolt" and a "machine screw" is. Answers have come, but not satisfactory — more are expected. I have n't yet found any bolt manufacturer who knows what a "lewis-bolt" is.

Your satellite,
J. D. W.

With this, ends the episode of the Century Dictionary, much, it is said, to the relief of President Eliot, who begrudged eight years' distraction from Whitney's scientific work.

TO WILLIAM DWIGHT WHITNEY

CAMBRIDGE, *February* 9, 1892.

MY DEAR W. D. W., — . . . There is a recess or absence of lectures just now, on account of the mid-year examinations; but I think it would be prudent for me to refrain from leaving home at present, while we are likely to have very sudden changes of the weather; because I am trying to get over an attack of the grippe, and riding on the cars in very cold weather is trying to me, chiefly because they keep them so hot. If you please, I will save your invitation for later, when the snow and the grippe shall have gone off together.

I have already reported on your Max-Müllertary[1] opus—or opuscule,—if that designation seems to you more suitable.

Yours as ever,
J. D. W.

[1] That is: What Smax of War.[2] Almost a "Thirty Years' War," I should say, by this time.

[2] To this you may remark, and, with propriety, that you have heard of "sloops of war" but never of "smacks of war"!

And you have not forgotten, I hope, that in the unrevised Century, a *severe kiss*, or one of hostile character, was said to be always "accompanied by a smack." Whereupon the unregenerate commentator added, "smacktions speak louder than words."

TO WILLIAM DWIGHT WHITNEY

CAMBRIDGE, *August* 10, 1892.

MY DEAR W. D. W.,—I am much obliged to you for your kind invitation to come down and cool off at your hospitable place of summer abode. Nothing would be more agreeable, but it does not seem possible just at this present time. . . . I will try to make . . . plans for our future movements and submit them to you . . . for your approval.

For some reason or other — perhaps because I have taken up the subject of Climatic Changes again for investigation — the weather has been playing us scurvy tricks this summer. To be up in the nineties is the regular thing nowadays. It is all right when you have a place of your own by the seaside — in the surf as it were — where you can stay all the time. But to run away for a few days, and sponge on your relatives, instead of sponging yourself at home, while bankrupt of brains and going into perpetual liquidation of body, does not seem to do much good. The weather is sure to take advantage of your absence, and there will be a drop of the mercury of 30° or so — as there was after the last hot spell, when the clerk of the weather was resting merely to take a fresh hold again; and that is just the time you select for your coastal, cooling-off convalescence! . . .

Do you remember when we were camped on a branch of the Ontonagon, near "Cushman's Location," how it was so hot that we went and sat in a shady pool of the river — not by it, but in it; and how the thermometer dropped 40° that afternoon in one hour! These are the kind of memories that haunt my soul at the present time.

FROM F. VON RICHTHOFEN

BERLIN, *August* 8, 1895.

MY DEAR PROFESSOR, — An age has passed since our last correspondence. I heard of you occasionally . . . and you have put me under obligations by sending me your masterly book on the United States, and the Supplement to it. It gave me pleasure to infer therefrom that you are well up and busy at work as it has always been your custom.

You had formerly the pleasant custom to come over to Europe occasionally and to pay a visit to Berlin. I was in hopes that you would do so again at the occasion of some geological or geographical congress, but since that woeful day — now about thirteen years ago — which bereft you of all that was most endeared to you, our continent appears to have lost its charm for you, and I must be prepared not to see you again. If, however, you should at any time allow your traveling spirits to revive, I hope to get news from you and the extent of your plans long before, that I may arrange to meet you. I should be so delighted, that I would make up my own plans accordingly. I never forget what you have been to me in California, and I recall with particular pleasure our joint trip to Lassen's Peak.

This is long ago; we have grown in age both of us, and many events have happened in the lives of each of us. I suppose you are busy at work in your exquisite library — which certainly has not ceased to increase—following up with unabated zeal all events in political and scientific life. And to these the "tempora mutantur" is no less sure than the "et nos mutamur in illis" applies to us. New problems have arisen politically, socially, and in the whole realm of science. I have admired your faculty to follow these changes, and your book on the United States fully proves that the universal character of your interests is unabated. . . .

My wife sends you her kind regards. I am glad you made her acquaintance in Bonn, but I ever regret that I was then absent. That was your last visit. I hardly think that we shall ever come to your country, our vacations being too short; and I missed the only good opportunity, which was given by the Geological Congress.

I remain in ever grateful memory,

Yours very sincerely,

F. von Richthofen.

Here we too may well take leave of Professor Whitney, busy in his exquisite library, following with unabated zeal the best that was being thought and done in the world. Thirty-one years he taught at Harvard, and died at Lake Sunapee, New Hampshire, August 19, 1896, in the seventy-sixth year of his age. "Although he suffered great afflictions during his residence in Cambridge," wrote the great President under whom he served, "I cannot but hope that he also had great satisfactions and much happiness."

Fortunate on the whole in his life, he was fortunate also in his death. He survived but two years his beloved brother; and he kept at his work almost to the end. In spite of some apparent feebleness of body during the last winter of his life, he finished his year's teaching: at no time was he confined to his bed. Thus was he spared the sad infirmities of old age; and he died, of sclerosis of the cerebral arteries, without pain and without fear.

He is buried at Northampton beside his wife and daughter. His gravestone, emblematic alike of his early work and of the interest of his later years, is a glacial boulder of rose quartzite of the geologic age of the lead district about Galena and the rocks of Upper Michigan which border the "Azoic System."

There are two kinds of scientific men. The

THE BOULDER

JOSIAH DWIGHT WHITNEY, 1819-1896

one, like Agassiz, Liebig, Jackson, through their personal qualities or their gifts of expression or their connection with some conspicuous discovery, achieve a popular reputation, not indeed beyond their desert, but in some degree commensurate with it. The other sort, Hall, Henry, Wolcott Gibbs, careless of the amateur and the undergraduate, influence profoundly the opinions of their highly trained associates, and remain without honor save in their own country. To few is it given to choose to which group they shall belong.

Whitney, though he belongs on the whole to the second group, has certain affiliations with the first. The Calaveras skull was a famous matter in its day; his magazine articles gave him a popular audience, which he might easily have increased, for no reader of the foregoing letters or of the Yosemite guidebook can question his command over his mother tongue. He had an interesting mind, and he lived through one of the great periods of his science. He might have written a successful text-book, for he had much of Dana's learning and all of Le Conte's skill, while in actual field experience he surpassed them both together.

More or less deliberately, he chose the narrow way. He filled a long lifetime with sound professional work: his monument is the unrivaled collection of books which he gave Harvard University, his reports on the natural resources of six states, a topographical method which will in time map the whole of North America, and two generations of professional geologists and topographers whom he trained.

No other time than our own has produced the type of men with whom Whitney belongs, the highly trained specialists, men of science and engineers, who go about their daily tasks, knowing that their work shall abide, built into the fabric of our civilization. When all is said, it is upon men like these that our civilization rests.

TITLES, APPOINTMENTS, AND MEMBERSHIPS IN LEARNED SOCIETIES OF JOSIAH DWIGHT WHITNEY

Assistant Geologist, New Hampshire State Geological Survey. 1840.

Boston Society of Natural History; Resident Member. 1841.

United States Geologist for the Lake Superior District. 1849.

American Academy of Arts and Sciences; Honorary Member. 1850.

Albany Institute; Corresponding Member. 1851.

Academy of Natural Sciences of Philadelphia; Corresponding Member. 1852.

State Chemist of Iowa. 1855.

Société géologique de France; Honorary Member. 1855.

Chicago Academy of Sciences; Corresponding Member. 1859.

State Geologist of California. 1860.

California Academy of Sciences; Resident Member. 1861.

Philalethic Literary Society of Santa Clara; Honorary Member. 1863.

American Philosophical Society; Life Member. 1863.

National Academy of Sciences; Life Member. 1863.

Harvard University; Sturgis-Hooper Professor of Geology. 1865.

Essex Institute; Corresponding Member. 1866.

Societas Naturae Scrutatorum Helvetorum; Honorary Member. 1866.

Yale University; Honorary LL. D. 1870.

Mercantile Library Association of San Francisco; Honorary Life Member. 1871.

Royal Geographical Society of London; Honorary Corresponding Member. 1872.

Geological Society of London; Life Member. 1873.

Royal Scientific Society of Batavia; Corresponding Member. 1873.

Société royale des sciences de Liége; Corresponding Member. 1873.

Gesellschaft für Erdkunde zu Berlin; Honorary Member. 1874.

Sociedade de Geographia de Lisboa; Corresponding Member. 1877.

Geological Society of London; Foreign Member. 1887.

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II

MAPS

* Geological map of the Lake Superior land districts in the State of Michigan. By J. W. Foster and J. D. Whit-

ney, U. S. geologists. N. Y. [1847?] Scale, $11\frac{1}{10}$ miles to 1 inch.

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* Maps so marked accompany Part 2 of the Report on the geology . . . of the Lake Superior land district.

* Geological map of the district between Keweenaw Bay and Chocolate River, Lake Superior, Michigan. J. W. Foster and J. D. Whitney, U. S. geologists. [N. Y.? 1847?] Scale, $2\frac{7}{10}$ miles to 1 inch.

* Section and diagram illustrating the geology of the region between the northern shores of Lakes Superior and Michigan.

> No name of authors on the map, but certainly by Foster and Whitney.

† Geological map of Isle Royale, Lake Superior, Michigan. By J. W. Foster & J. D. Whitney, U. S. geologists: assisted by S. W. Hill and W. Schlatter. New York. Ackerman. 1847. Scale, 2 miles to 1 inch.

† Geological map of Keweenaw Point, Lake Superior, Michigan. By J. W. Foster and J. D. Whitney, U. S. geologists: S. W. Hill and W. Schlatter, assistants. Philadelphia. Duval. [1850?] Scale, 2.7 miles to 1 inch.

† Geological map of the district between Portage Lake and Montreal River, Lake Superior, Michigan. J. W. Foster and J. D. Whitney, U. S. geologists: S. W. Hill and W. Schlatter, assistants. Philadelphia, Duval. [1847?]. Scale, 2.7 miles to 1 inch.

Geological map of Keweenaw Point, Lake Superior, Michigan. New York, 1850. Scale 12 miles to 1 inch.

Same. 1853.

> Mr. Whitney was assisted by S. W. Hill and W. S. Stephens.

†† Geological map of the lead region in the States of Wisconsin, Illinois and Iowa. [Albany. 1862.] No scale.

* Maps so marked accompany Part 2 of the Report on the geology of the Lake Superior land district.

† Maps so marked accompany Part 1 of the Report on the geology of the Lake Superior land district.

†† Maps so marked accompany Report on the Geological Survey of the Upper Mississippi lead region.

†† Diagram of the lead-bearing crevices, in that portion of the Upper Mississippi lead region which lies between Dubuque, Galena and Shullsbury. [Albany. 1862.] No scale.

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Map of a portion of the Sierra Nevada adjacent to the Yosemite Valley, from surveys made by C. F. Hoffmann and J. T. Gardner. 1863–67. [New York. Bien. 1868.] Scale, 2 miles to 1 inch.

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** Distribution of the volcanic formations and gravel near Placerville. [Cambridge. 1880.] Scale, 1 mile to 1½ inches.

** Section and plan of Spanish Peak gravel deposit. [Cambridge. 1880.] Scale, 160 feet to 1 inch.

** Map of the mining district adjacent to Forest City. [Cambridge. 1880.] Scale, 1 mile to 1 inch.

** Map to accompany the description of a portion of the region drained by Slate, Cañon and Goodyear Creeks in Sierra and Plumas Counties. [Cambridge. 1880.] Scale, 2 miles to 1 inch.

** Maps so marked accompany The Auriferous gravels of the Sierra Nevada of California.

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